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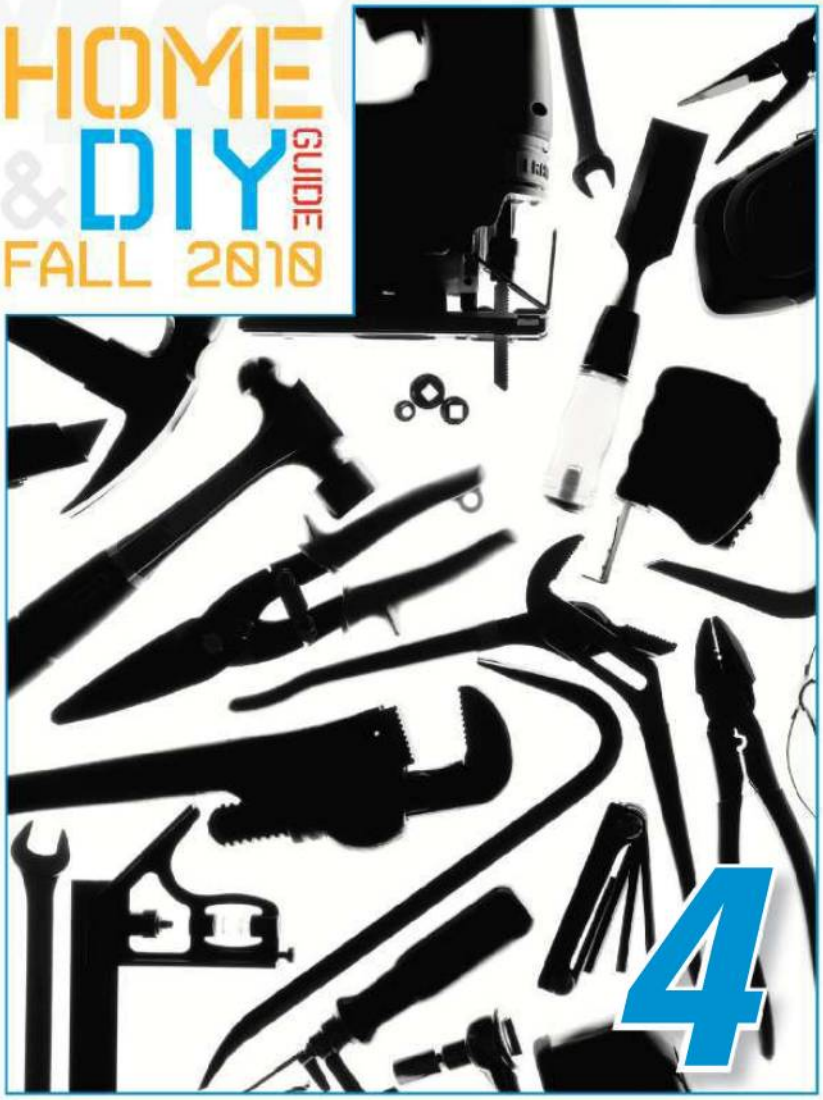

Please enjoy this selection of articles from the pages of Popular Mechanics magazine, offering a useful and entertaining array of home DIY ideas, tips and projects. In addition to all the valuable ideas and information, you'll find links on the ad pages enabling you to purchase products immediately on Amazon.com—so you can go ahead and get started on all of your fall clean up and home improvement projects.

— Bill Congdon, Publisher

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50 TOOLS WE CAN'T LIVE WITHOUT

If PM could design the perfect toolkit, these are the DIY essentials we'd put in it. Now, all we need is a really big box.

Man is "weak in himself, and of small stature," wrote 19th-century essayist Thomas Carlyle. Yet, with tools, "the granite mountain melts into light dust before him, seas are his smooth highway, winds and fire his unwearying steeds." And this from a guy who never felt a 5800-rpm circular saw scream to life in his hand.

While much has changed since Carlyle's day, one thing hasn't: We need tools to build, repair and maintain the mechanical world in which we live. With these 50 tools, you'll be ready for just about any project—whether it's melting mountains or swapping out the kitchen sink.

By Logan Ward

Photograph by Charles Masters

Portraits by Sarah Shatz

1. Sledgehammer

● Few tools combine brute force and finesse as elegantly as a sledgehammer. Swing it overhead to deliver bomb-blast destructiveness or to fire a wood-splitting wedge through a big log. Handle it like a putter to salvage architectural elements such as a post-and-beam barn frame that needs knocking apart. Most of us are better off with an 8- or 10-pound model that we can swing easily, not a 16- to 20-pounder.

2. Center Punch

● In theory, you use a center punch to start holes in metal. In practice, it's far more useful than that. You can tighten a loose handle on a knife or shovel by centering the punch on the rivet and then firmly striking it with a ball-peen hammer, expanding the rivet's head. In a pinch, you can also use a center punch like a steel pencil to mark a line on wood or metal. Or you can use it to countersink a large nailhead or drive down the stub of a broken nail or staple.

3. Putty Knife

● The putty knife is more than a single implement. Rather, it's a group of tools, ranging from knives with flexible, thin blades to heavy-duty models that are ground with a tip like a chisel (which, not surprisingly, are called chisel-edge putty knives). Better tools have a high-carbon steel blade; plastic, disposable ones are perfect for the no-scuff application of putty on painted surfaces.

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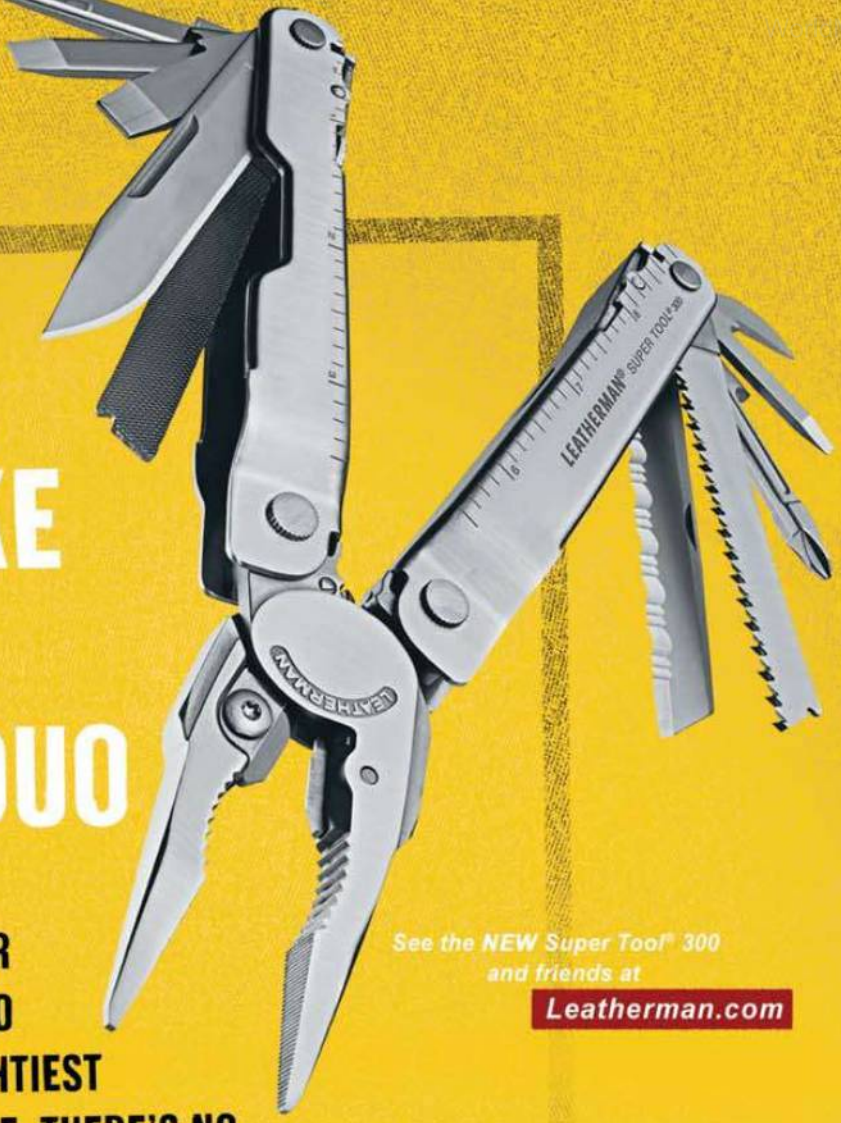
TOGETHER, WE'LL MAKE A PRETTY DYNAMIC DUO



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4. Safety Glasses

● DIY projects may come and go, but you won't get a second shot at good vision—protecting your eyes should be your first priority. Opt for high-impact safety glasses over those rated "basic impact." For maximum protection, wear high-impact goggles because they cover more of your face and the area around your eyes.

5. Adjustable Wrench

● For portability and convenience, you can't beat the time-honored adjustable wrench, which enables you to turn a wide range of nuts and bolts with a single tool. If you're going to own just one, make it a 10- or 14-inch model so that it's big enough for residential plumbing fittings. Pull it so the reaction force is applied to the fixed jaw, not the movable one.

6. Pipe Wrench

● A pipe wrench may not be versatile, but when you need to hold a pipe and fittings, nothing else will work. The body is rigid and heavy, and the teeth bite forcefully into smooth, round surfaces. While most pipe wrenches are cast iron, spring for an aluminum model if you face a long day of plumbing.

7. Socket Wrench Set

● Reach for a socket wrench when you need to tighten fasteners or loosen frozen ones. The ½-inch drive is the heavy hitter of the socket wrench kingdom, followed by a switch hitter, the ⅜-inch drive, which is big enough to do light-duty automotive work yet small enough for some appliances. Reserve the ¼-inch drive for appliance and electronics repair.

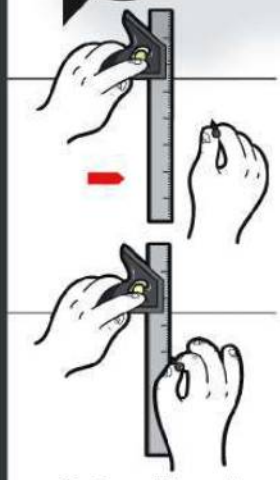
AIRCRAFT RESTORER

Will Lee

MUST-HAVE TOOL: metal file (8)

If the deadly twin-engine Heinkel 219 had been available in larger numbers, some World War II historians speculate, Germany might have stopped the Royal Air Force bombing that hastened the end of the war. As it was, fewer than 300 of the gun-bristling night fighters were made. Today, one remains, and the Smithsonian National Air and Space Museum's Will Lee is slowly piecing it back together. Along with a rawhide mallet for hammering aluminum, the aircraft restorer's go-to tool is a metal file. He relies on four dozen files to finesse excess metal—both single- and double-cut, triangular and those he's cut down to shave rivets. "With a file, I can get right down to the lines I've scribed," says Lee, who did electrical work and built prosthetic limbs before joining the Smithsonian in 1990. He prefers hand tools for the most precise fits. "I seem to have more control doing it the way I've been doing it for years," he says.

Tip



9. Combination Square

● **Used for marking out, measuring and testing the squareness of corners, the combination square is versatile and accurate. For maximum precision, first position your pencil (or the scratch awl stored in the head), then gently slide the square to the pencil (or awl) and strike your line. Check the tool's accuracy by marking a line 90 degrees to a straightedge. Flip the square and make another mark next to the first. If the two lines are parallel, the square is, well, square.**

STYLING BY MEGAN CAPONETTO (OPENER)

STILL LIFES BY **CHAD HUNT** DIAGRAMS BY **ILL.DESIGN**

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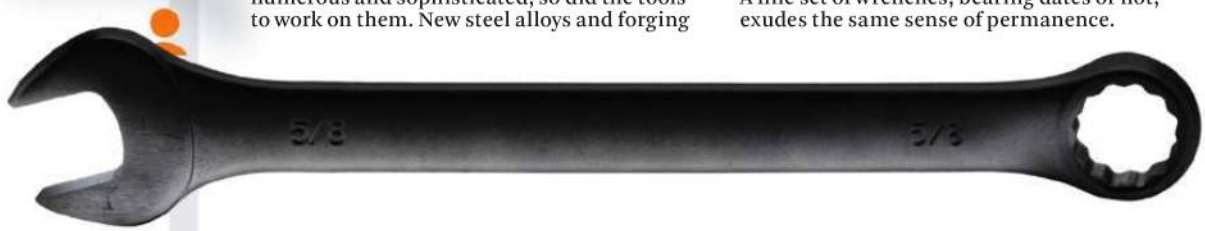
Classics

10. Combination Wrench

Your wife has the family silver tucked away in a felt-lined box, and you've got your set of combination wrenches. The tool's design is prototypically simple—box-end on one side, open on the other. It has no moving parts and is covered in shiny chrome. If you're lucky enough to have inherited the set from your dad, that makes it as precious as the silver, while cheaper to insure. No one knows who invented the combination wrench or when, but it was popularized in the U.S. by Plomb Tools in the 1930s, a period of social and technological ferment. As automobiles became more numerous and sophisticated, so did the tools to work on them. New steel alloys and forging methods have only improved the wrench with the passage of time. Today's wrench is thinner, sleeker and stronger than the bulky ones it replaced; it weighs half what it did in the '20s. While it is hard to improve on perfection, in 2006 Craftsman introduced a new twist—literally—in its Cross-Force Combination Wrenches, turning the handle so your palm presses on the tool's broad face, not the narrow edge. Back when blacksmiths forged tools, they would inscribe the year onto the head as if to announce that it would last decades, maybe centuries, into an uncertain future. A fine set of wrenches, bearing dates or not, exudes the same sense of permanence.



11. Bow Saw

● The bow saw is a simple recipe for wood-cutting success: a ribbon-thin steel blade with sturdy teeth tensioned in a steel frame. And it's safer than a chain saw for removing tree limbs while standing on a ladder.

12. Jigsaw

● Because a jigsaw cuts with an up-and-down motion and its blade is comparatively narrow, it excels at cutting curves in wood, metal and plastic. Advanced models have an orbital setting that also moves the blade in a swinging motion for aggressive woodcutting.

13. Coping Saw

● A hand tool with a thin blade stretched in a C-shaped frame, the coping saw is also adept at intricate cuts: It is named for the technique of coping, or cutting, joints where two pieces of molding meet. As with any saw, choose a blade with more teeth for a finer cut, and one with fewer teeth for faster, somewhat rougher cutting. A blade with 15 teeth per inch, or tpi, should do the trick for general use.

14. Side-Cutting Pliers

● Call them side cutters, linesman pliers or electrician's pliers. By any name, the heavy jaws and shears make them indispensable for cutting electrical cable and for pulling the steel tape used to fish wires through wall and ceiling cavities. Models rated as "high leverage" can cut nails and bolts, while those equipped with a die near the jaws can press together the crimp connectors used on grounding wires.

15. Hacksaw

● The fine-tooth blade of a hacksaw can cut through iron and steel, as well as through tough materials like hard plastics and cable. With a blade known as a carbide-grit rod saw, it can even slice ceramic tile. For metal, use a carbon-steel blade with 14, 18, 24 or 32 tpi. Opt for a bimetal blade for high-tension pro models, which exert tremendous tensile force in order to hold the blade arrow straight in tough cuts. The bimetal blade's carbon-steel back, bonded to a high-speed-steel front, can take the tension.

16. Crosscut Saw

● Even if you own an arsenal of power saws, an eight-point crosscut saw should be somewhere in your shop. It may not make the finest cut, but it's the perfect jack-of-all-trades saw for small jobs, like the occasional 2 x 4. Hold the saw so that its toothed edge is 45 degrees to the work surface, and start the cut by drawing the saw back very lightly. Use full strokes, engaging as much of the toothed surface as possible.

17. Snips

● You don't have to be a metalworker to appreciate snips. This tool cuts sheet steel, copper and aluminum, but also rubber, heavy cardboard and plastic. Pro models have color-coded handles to indicate whether they are designed for left curves, right curves or straight cuts (red, green and yellow, respectively). Homeowners can get by with a single, all-purpose utility snip.

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TOOLS

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18. Roundnose Shovel

● The roundnose shovel digs, cuts and pries, but, like any tool, its efficiency depends on you. Start with the shovel perpendicular to the soil, and use your weight and leg muscles, not your arms, to drive it down. To toss dirt, hold the shovel close and keep your forward hand on the blade socket. Bend both knees. If you're right-handed, point your left foot in the direction of the toss.

19. Needle-Nose Pliers

● When you need to fish a dropped screw out of a tight space, when working on electronics for example, there's nothing handier than a pair of needle-nose pliers. Their elegant shape is also perfect for fastening a wire to a switch or outlet receptacle: Grip the wire at the tip of the jaws and roll the pliers to produce a neat hook, then fasten the hook under the terminal screw.

20. Drill

● Cordless drills readily combine speed, power and portability—so for most of us, they've already replaced the corded variety. They also come with a clutch that disconnects the drive mechanism when it reaches a dialed-in force setting, preventing the user from stripping the screw. While 14- to 18-volt models can handle most jobs, some drills have voltages in the mid-20s or even 30s for power that rivals that of the corded product.

21. Drill Bits

● For almost all general hole drilling, most of us can get by with a set of 15 or 18 high-speed-steel twist drill bits. You don't need to upgrade to a full set to deal with special circumstances, such as knocking a hole through a brick wall or boring through nail-infested lumber. Buy these expensive, single-purpose bits one at a time. As the years pass, the specialty bits add up, allowing you to tackle any job that comes along without a trip to the hardware store.

22. Locking Pliers

● An early multitool, locking pliers—patented in 1924—are sometimes known by the brand name Vise-Grip. They function like ordinary pliers but also as a wrench or welding clamp. Their powerful grip works well to remove stubborn nails or fence staples.

23. Level

● A 9-inch torpedo level is perfect for small jobs like hanging pictures, but you need a 2-foot or longer carpenter's model for bigger projects, such as leveling appliances and bookshelves or plumbing posts to support a fence or mailbox. Another bonus: Long levels make a nice straightedge.

24. Circular Saw

● Nothing beats a circular saw for speed and convenience when it comes to making straight cuts on a variety of materials. It can crosscut lumber or rip plywood, of course. But with a nail-cutting blade, a circular saw can also do demolition work; with an abrasive blade, it can saw through masonry and metal.

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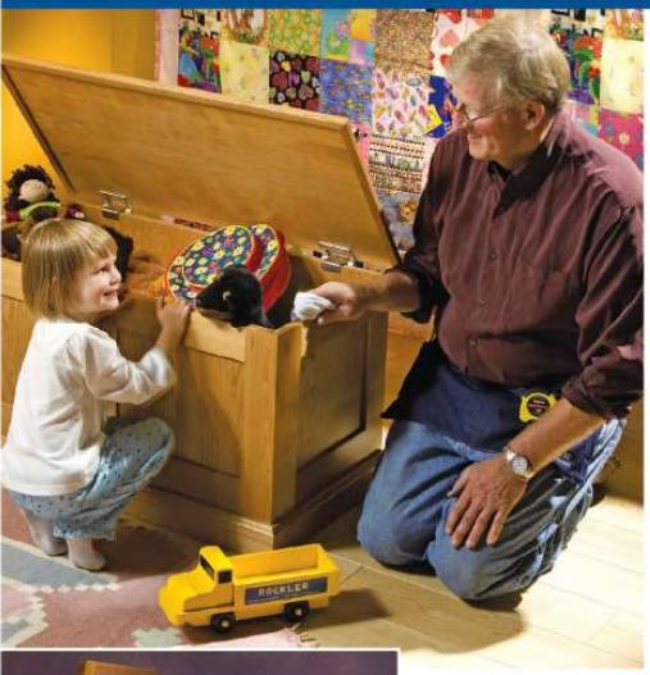

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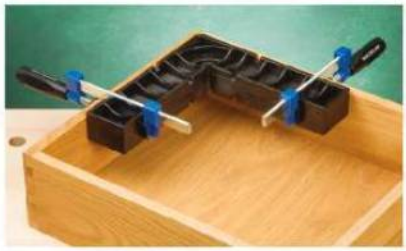

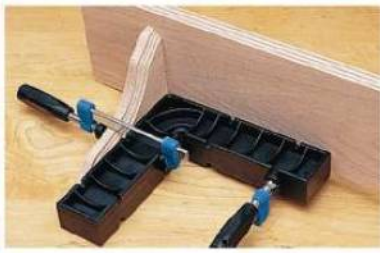

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TOOLS

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25. Spray Lube

● There are a lot of good spray lubricants, such as Liquid Wrench and Jig-A-Loo, but the most iconic is WD-40. The name stands for Water Displacement 40th attempt, since it took inventor Norm Larsen, founder of the Rocket Chemical Company in San Diego, 40 tries to find a formula to stop metal corrosion by displacing the water that causes it. WD-40 removes adhesive, cleans bike parts, stops squeaks and loosens rusted bolts. And it has a few more unusual applications: Police once used it to remove a naked burglar stuck in an a/c vent.

ARCHITECTURAL SALVAGER

Eddie Hibbert

MUST-HAVE TOOL: dust mask (28)

For the past quarter-century, Eddie Hibbert has patiently restored old mantels, doors and other brownstone artifacts, becoming a living legend in the New York City salvage community. Despite the friendly, informal atmosphere around his Brooklyn shop, the work is made hazardous by wood chips, flying debris and lung-choking dust—some of which emanates from pieces that predate the 1978 U.S. ban on lead-based paint. "That stuff will kill you," Hibbert says. That's why his crucial tool isn't a scraper or a sander—it's a respirator. The National Institute for Occupational Safety and Health recommends a disposable or cartridge-type half mask (not pictured) with a P100 rating to remove lead dust. For Hibbert, buying the best respirator he can find is money well-spent. Breathing new life into old architectural pieces is Hibbert's job—but, he says, protecting his lungs is more important.

26. Tape Rule

● A measuring tape is a spring-loaded marvel, combining compactness and speed. Poke its tip down to the intersection of floor and wall, then bend it up the wall to measure ceiling height. Extend it horizontally and it's stiff enough to bridge several feet of open air. A 25-foot model is sufficiently long to handle most home construction jobs, yet small and light enough to stash in a nail pouch or clip to your blue jeans.

29. Nail Set

● A nail set allows you to countersink nailheads without damaging the surrounding surface, then conceal the holes with wood filler. While you can use a set that's one size larger than you need, don't try to use an undersize one—this can damage the tool's cup-shaped tip. To ensure you've got the right size, get a set of four: 1/32-, 1/16-, 3/32- and 1/8-inch.

30. Machinist Vise

● Whether stationary or swiveling, a vise is like an extra set of (really strong) hands for securing your work. Cast-iron models function well for most applications, but buy a forged-steel vise for anything heavy-duty. If you cut a lot of pipe, choose a vise with V-shaped jaws to grip round material. For moderate metal pounding, choose one with an anvil behind the jaws. While it's no substitute for a blacksmith anvil, it is handy for small projects.

Classics

27. Hammer

In 30,000 B.C., someone altered the destiny of the human race by lashing a stick to a rock, a refinement that increased the user's strike speed and accuracy. The hammer was born. Later, stone begat bronze, begat iron, begat steel—a material that could be forged into a ruthlessly efficient shape. Yet, after all these millennia, the wood handle remains, preferred by craftsmen for its light weight, shock absorbency and balance. It was the post–World War II housing boom that finally transformed the profile of the modern hammer. Can't-frame-'em-fast-enough carpenters on the West Coast needed still more speed, so they grafted elements of heavy-rigging hatchets onto claw hammers. The result is the beefy, all-business, California-style framer, a swift, long-handled striking tool with a vicious claw. A nail gun might be fast, but nothing beats the feeling of sinking a nail in two or three clean hits.

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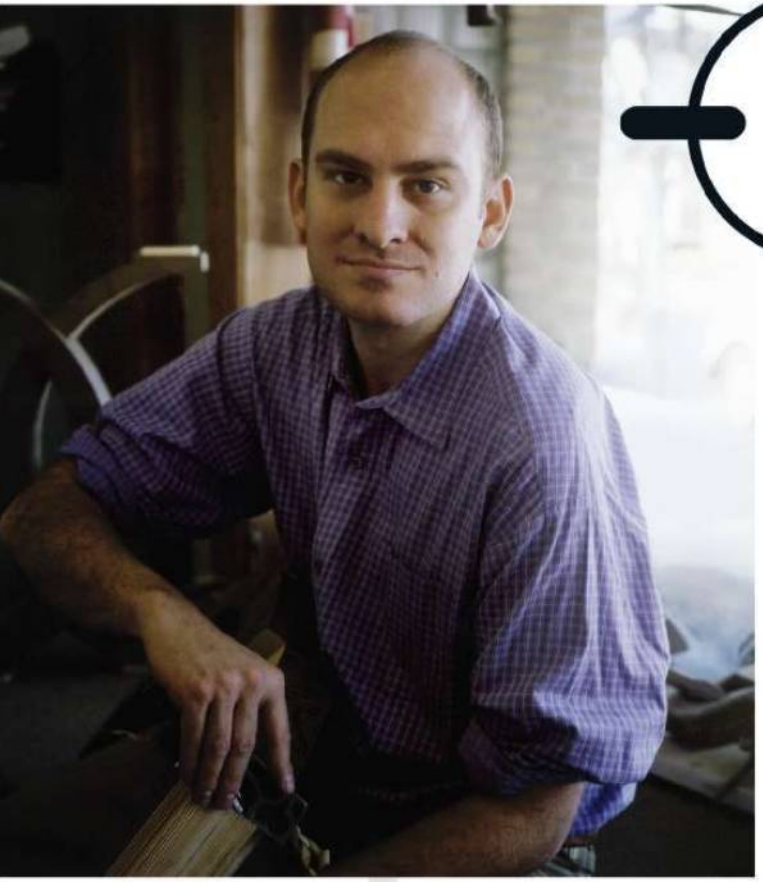

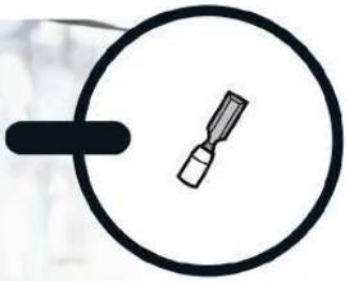

FURNITURE MAKER

Keith Fritz

MUST-HAVE TOOL: wood chisel (31)

"My favorite tool is a big, flat 10-inch chisel with a boxwood handle," woodworker Keith Fritz of Jasper, Ind., says. "It's English, made in the 19th century and has a good weight to it. That's the tool in my hand the most." Fritz grew up in the no-stoplight community of Siberia, Ind., where both his father and grandfather farmed land and worked wood. As a high school student, he won back-to-back annual statewide competitions, one of them for an intricate Chippendale-style secretary with slots, drawers and secret compartments. Planning to study theology, he moved to Washington, D.C., and attended Catholic University but heard the call of furniture-making instead. Bill and Hillary Clinton own one of his dining tables, which sell for up to $30,000. A few years ago, Fritz moved his shop from the seminary's basement to Jasper. There, he builds furniture inspired by old designs using mostly hand tools—and never a scrap of sandpaper. "You can tell an antique is real by looking at the tool marks," he says. "Pre-1880, there was no sanding involved. I can get the same effect with a really sharp chisel."

32. Chalk Line

● As technology goes, the chalk line is incredibly simple—a cranked spool of string that runs through a reservoir of powdered chalk. But for marking a straight line when ripping long boards, or for laying out wall plates while house framing, nothing fancy works better.

33. Allen Wrench

● Also known as hex keys, Allen wrenches are not wrenches in the conventional sense but are more like screwdrivers, as they fit inside the fastener head rather than surrounding it. They're handy for knock-down furniture and setscrews on faucet bodies.

34. Earmuffs

● Hearing damage is permanent, but it's also preventable. Earmuffs, as opposed to earplugs or headphones, provide maximum protection. Really loud shop tools, such as chain saws and circular saws, may operate above 100 decibels—and noise higher than 85 decibels begins to cause damage. Choose a product that has a high noise-reduction rating (NRR)—preferably in the range of 23 to 33.

35. Flashlight

● A flashlight is useful for more than emergency power outages. Select a freestanding swivel-head model for brightening dark work areas. Choose one with a built-in magnet to adhere to pipes, steel beams or the inside of an appliance that you are repairing. For truly rugged use, opt for an LED light with as high a drop-test rating as possible: Some industrial-quality flashlights are rated for falls as high as 25 feet.

36. Bow Rake

● Rugged and simple, the bow rake remains the best device for raking heavy material, such as gravel or tangled sticks. The bow acts as a shock absorber, protecting your arms while you work. If you turn it over, the straight back can also be used to level soil.

37. Volt/Ohmmeter

● This tool is far more versatile than its two-part name suggests. Aside from measuring voltage and resistance (ohms), it also measures current flow (amperage), and most modern versions emit a tone to signal a complete circuit (continuity).

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39. Ball-Peen Hammer

● The face of a ball-peen hammer strikes cold chisels and punches, while the dome-shaped end rolls over the edges of rivets (peening) or works curved sheet metal. The hammer ranges in size from 4 to 50 ounces (with large models serving as blacksmiths' hammers), but the 16-ounce size works well and fits in crowded toolboxes.

38. Cold Chisel

● **Use a cold chisel to chop through bolts, rivets and pins and to cut cold (as opposed to torch- or forge-heated) metal. Strike it with a ball-peen hammer, preferably one with a head ⅛ inch larger than the end of the chisel. You can get a better view of the tip by gripping the body with tongue-and-groove pliers. Always wear safety glasses when striking a cold chisel, and never use it on stone or concrete.**

40. Multibit Screwdriver

● Because your screwdriver tip should match the head of whatever screw you're turning, a screwdriver with interchangeable tips is a compact, convenient alternative to a drawer full of tools. Plus, a handheld screwdriver often gets small jobs done faster than a cordless one.

41. Gooseneck Bar

● This is also called a wrecking bar—for good reason. A curved neck gives the steel tool incredible prying power, perfect for separating two pieces of lumber that are nailed together. Rely on small models up to 18 inches long for light-duty demolition, but graduate to a 36-inch bar for the big stuff.

42. Utility Knife

● A utility knife cuts drywall, slices string and duct tape and sharpens carpenter's pencils. What more utility could you want? Okay, better blade storage. But advanced designs have swing-out blade loading, as opposed to a cranky, hollow, two-piece body.

43. Pry Bar

● Shorter and flatter than a gooseneck bar, a pry bar is most useful for removing trim and paneling. Many variations exist, but the most versatile types have at least one nail-pulling slot (two is better).

44. Square-Nose Shovel

● The square-head design makes this shovel ideal for scooping debris and measuring material. When using it to place concrete, work the back of the blade against the inside surface of a slab form to consolidate concrete there. The long, flat blade is also handy for popping drywall off walls during demolition.

45. Extension Ladder

● Ranging in length from 16 to 40 feet, extension ladders put most projects safely within reach. To ensure you don't buy a ladder that comes up short, buy one at least 7 feet longer than the height of the object you need to reach. When in doubt, check the manufacturer's label to compare the ladder's length to its actual reach.

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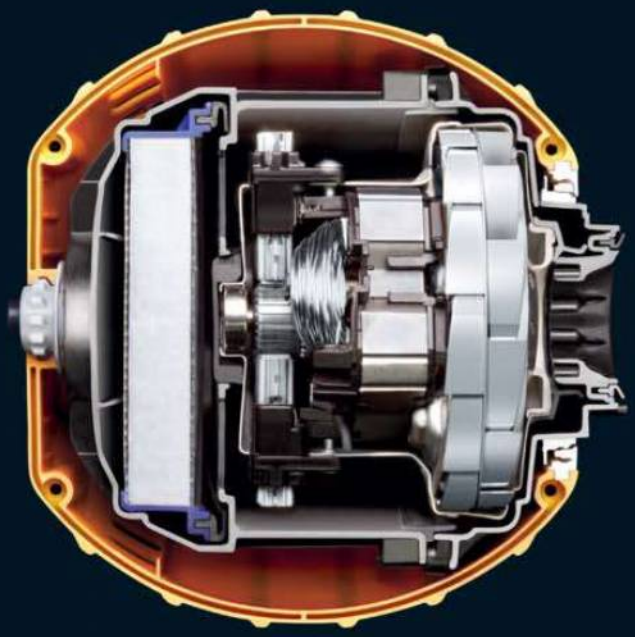

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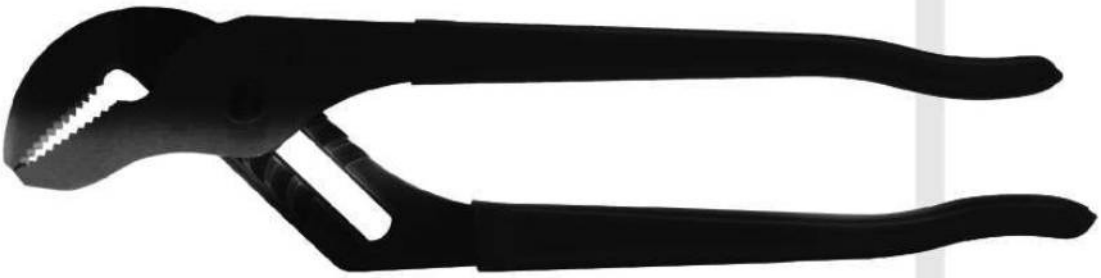
Classics

46. Tongue-and-Groove Pliers

Howard Manning, chief engineer for the Champion DeArment Tool Company, invented tongue-and-groove pliers in 1933, improving on standard designs by adding length and leverage and increasing jaw width. The new tool caught on among car mechanics, who used it to repair water pumps. In 1953, the company's engineers redesigned the tongue and groove, undercutting the tongue to give the tool a firmer bite—a tweak that prevents it from slipping and busting your knuckles. They've made other improvements over the years, but the instantly recognizable grip color—probably the only hand-tool color ever trademarked—has remained the same. "Back in the early 1950s, all the plier manufacturers started putting colored PVC on their grips," says Bill DeArment, great-grandson of the company's founder. Crescent chose red; Stanley Tools, yellow. DeArment's father and uncle picked a beautiful sky blue that no one else had—and the company has used that color since 1956. In 1962, Champion changed its name to Channellock; DeArment is the president and CEO. And today, tongue-and-groove pliers are an essential for mechanics, farmers, plumbers and average joes everywhere.



47. Pick

● A pick is like a pipe wrench—not very versatile, but when you need it, nothing else works nearly as well. If you spend most of your time breaking up hard, rocky soil, get a railroad pick—the type with two pointed ends, or a narrow chisel tip on one side and a pick on the other. Although using a railroad pick to break soft and medium-hard rock has become a dying art, it can be done when the rock already has a crack into which you can drive the tip of the pick. The tool can also be used for chopping through asphalt, and it's effective at severing roots when equipped with a pick blade on one end and a mattock on the other.

48. Stepladder

The safest way to reach things inside the house is with a properly sized step ladder. Although they range in height from 3 to 20 feet, the most useful ladders are those in the 6- to 10-foot range—tall enough for you to change light bulbs but not so large as to be unwieldy. If you need to gain height in an awkward location, such as on the stairs, a multiposition ladder solves the problem with hinged and telescoping legs that adapt to uneven footing.

50. Extension Cord

● Large jobs require corded tools—and an extension cord to match. The minimum spec for most DIYers should be a 14-gauge cord rated for 15 amps. But a 12-gauge cord is better, and a 10-gauge contractor-quality cord better still, because it ensures minimum voltage drop along its length.

CATTLEMAN

Mark Roeber

MUST-HAVE TOOL: rope (49)

"Everything we do involves some type of tool," says Mark Roeber, a fifth-generation cattleman who runs a cow-calf operation in Paonia, Colo. "It's the lifeblood of how we get things done." Roeber reproduces and raises cattle on a ranch that has been in his family since 1889. But for six months of the year, his 400-odd head graze on 90,000 acres of federal land, 60 percent of which is roadless wilderness. So Roeber and his partners work on horseback, relying on one of the oldest and most versatile tools known to man: rope. Using both nylon and cotton ropes, Roeber lashes down packs, leads his horse and, when he's breaking in a new animal, rigs up a bitless bridle known as a bosal hackamore. He rides with a 35-foot lariat tied to the fork of his saddle. "Out on the range, that's how you catch livestock for doctoring or pull them out of bogs," Roeber says. When he rides off to repair fences, he loads a packhorse with a roll of wire fence, fence-mending tools and a folding pruning saw for clearing brush along the way. And he never parts with his folding knife: "I use it to get out of a wreck with a horse if I get caught up in the lead rope, for digging splinters out, sharpening a pencil, even writing on a tree to leave somebody a note."

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DIY Home

The Dirty War

GRIME BELONGS ANYWHERE BUT ON YOUR HOUSE'S SIDING OR SHOP FLOOR. HERE'S HOW TO PUT IT IN ITS PLACE.

BY LOGAN WARD

Inside

+ THE RIGHT CLEANERS
+ PRESSURE-WASHER TIPS

Spring cleaning around the home and shop may not be fun, exactly, but it is necessary. If there's any pleasure to be found in the work, it's in handling it efficiently. You already have a can-do attitude, otherwise you wouldn't be reading PM. And chances are you own a shop vacuum, and maybe a pressure washer. Here's the battle plan to win this dirty war.

Indoors

1 SAWDUST AND WORKSHOP CLUTTER

The chief culprit in workshop mess is sawdust. It's slippery underfoot and dangerous to breathe, so making short work of it should be your first priority. Begin by suiting up. Wear a dust mask and old clothes or, better yet, coveralls. Yeah, we know, it's something out of your dad's generation—but keeping a pair of coveralls hanging in the shop will make it easier to keep clean. Store them there to keep grime out of the house and cut down on dusty laundry. Your dad was right about a few things.

Begin sawdust cleanup by working from the top of the shop down. Brush or vacuum off the tops of

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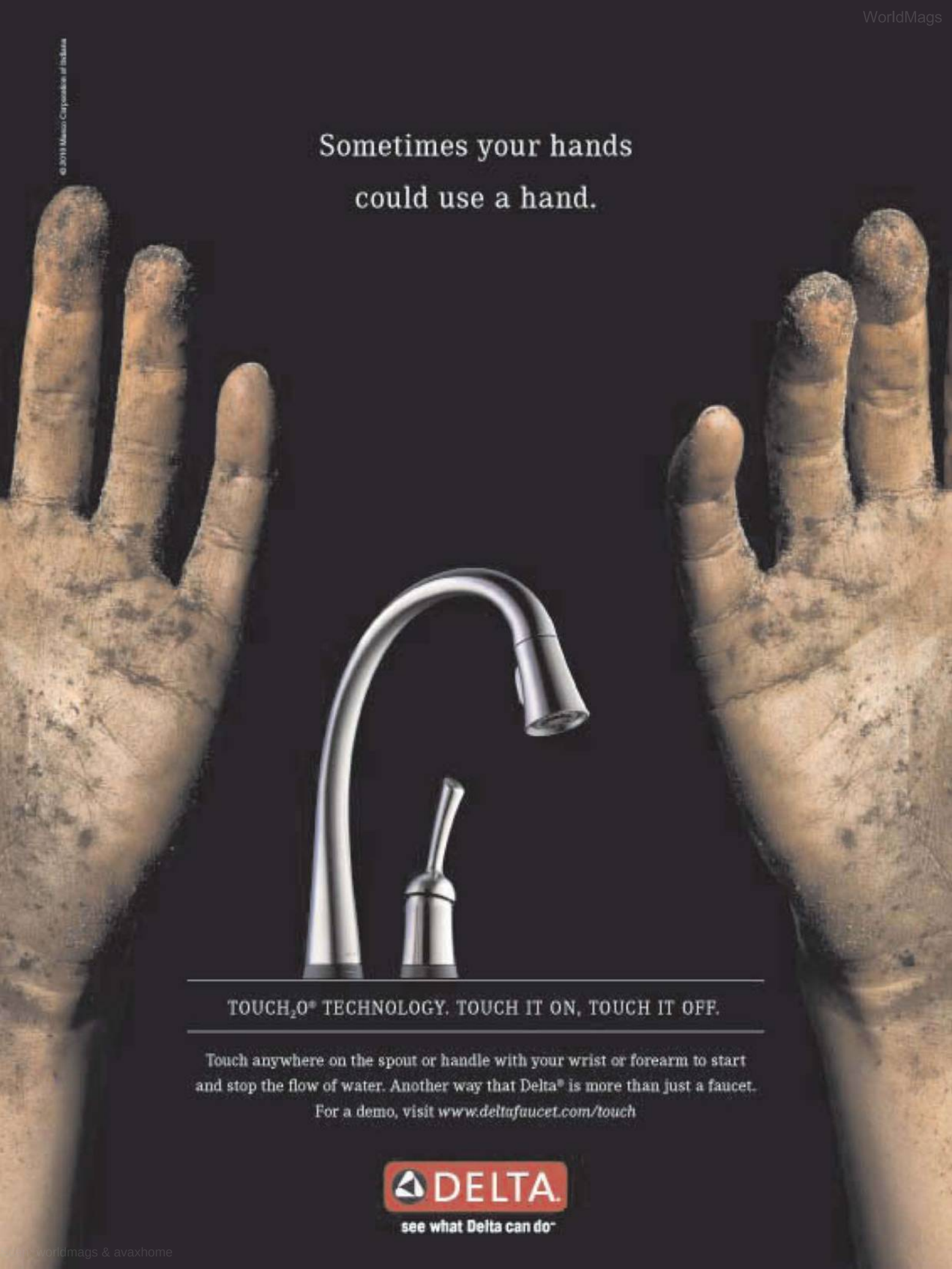
Sometimes your hands could use a hand.



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hanging fluorescent shop lights. Speed the job along by buying an extra length or two of hose for your shop vacuum, enough to reach every corner of your shop. This makes post-project cleanup quick and easy; instead of having to roll the vacuum cleaner around the shop, you simply walk the hose around.

Once the floor and shelves are free of dust, turn your sights on bench-top clutter. Make sure every tool has a home by hanging hand tools on pegboard or storing them in boxes, but keep tools you're using in a plastic tote. That keeps them portable—and off the bench top. You can put them away when you're done.

2 GARAGE FLOOR GREASE AND OIL

You're better off dealing with spilled lubricants and auto fluids while they're still liquid. They're a lot easier to remove in that form than after they've soaked into a concrete floor. Sprinkle on an absorbent powder—while everyone has heard of using kitty litter, you can also try dry cement or sawdust. Leave it for a few hours, then sweep up. If you really want to do a thorough cleanup, wet the area and sprinkle liquid dishwashing detergent, such as Cascade. Wait a few minutes. Pour boiling water on the area and scrub with a stiff-bristled brush. Then rinse.

3 BASEMENT MOLD AND MILDEW

A moldy basement is a sign that you've got a moisture problem. So don't bother cleaning until you've found the cause and completed foundation repairs and drainage projects. After that's out of the way, cleaning is a piece of cake. Kill mold and mildew by mopping with a solution of a half-cup to 1 cup of chlorine bleach to 1 gallon of water. A squirt of nonammoniated dishwashing liquid will help lift the mold and mildew from the surface. Rinse, then pick up standing water with a shop vacuum. Blot up what remains with old towels. Evaporate remaining moisture by circulating the air with fans.

4 GROUT

Don't feel bad if you've got moldy bathroom grout and tile. It can happen even if you clean conscientiously. We have a home-brewed formula to handle it (though you shouldn't use it on colored grout). Make a paste of Bon Ami Polishing Cleanser and chlorine bleach diluted with water. Ironically, people buy Bon Ami because it doesn't contain bleach or harsh abrasives, yet it's these qualities that make the product an ideal foundation for a bleach-based poultice. Scrub the paste over the tiles with a soft brush. Let it dry, and rinse it using a brush and a pail of water. Wash off the hazy residue with a damp cloth, and wipe dry.

5 FIREPLACE BRICK

Sure, the brick inside a fireplace is meant to get dirty. On the other hand, if it's really grubby, a good scrubbing goes a long way to brightening the room that it's in. First put on a dust mask and sweep up ashes and cinders. If needed, use a spray bottle and apply a fine mist of water to keep the dust down. Don't apply so much water as to create a slurry. To remove smoke stains, mix a half-cup of trisodium phosphate (TSP) in a gallon of hot water, or use a commercial scouring powder that contains bleach. Use the spray bottle and wet the brickwork with water, so that it won't sponge up whichever cleaning agent you choose.

Now, scrub with a stiff-bristled plastic or natural-fiber brush. You may be tempted to use a wire brush to scrub off the deposits, but don't do it. The brush is likely to damage mortar. Rinse the surface with warm water and blot the crud that comes off with rags.

FOR BEST RESULTS, MATCH THE CLEANER TO THE JOB.

	KILL GERMS	DISSOLVE SOAP SCUM	REMOVE GREASE	ATTACK DIRT
WHAT TO USE	Chlorine-bleach-based cleaners	Acidic cleaners	Dish detergents, powdered or liquid alkaline cleaners, solvents	Powder or liquid alkaline cleaners, such as those that contain ammonia or trisodium phosphate
WHY	A University of Michigan study concluded that bleach kills bacteria by attacking their proteins. Bleach also breaks apart light-absorbing molecules, lightening dark-colored stains. Of course, chlorine can also attack dark-colored fabrics or surfaces, discoloring them.	Soap scum is an alkaline precipitate, a layer formed after the water has evaporated, leaving behind a thin layer of soap and mineral particles. Acid-based cleaners such as vinegar and CLR (calcium lime rust) attack soap scum's alkaline chemical bonds.	Detergents contain surfactants, additives that reduce water's surface tension and help it dissolve the chemical bonds of grease molecules. Alkaline cleaners, such as dish detergent, attack greasy and oily acidic deposits. Solvents loosen molecular bonds, allowing grease and oil to be blotted up.	Alkaline cleaners break up and suspend soil molecules in water, allowing dirt to be flushed or scrubbed from a surface.

J MUCKLE/STUDIO D

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Outdoors

6 BARBECUE GRILL GRATES

Few things are as unappetizing as starting a nice family cookout on a nasty-looking grill. So scrape off the big stuff with a putty knife, then spray the grates with a noncaustic oven cleaner. Seal them up in a plastic garbage bag and let them sit overnight. Scrub with a brass brush and rinse with a garden hose; then get on with the family feast.

7 ALUMINUM AND VINYL SIDING

Dirty siding: bad. Clean siding: good. If only this job were that simple. Begin by covering outside light fixtures or electrical outlets with plastic bags. We admit that this next part sounds odd, so bear with us. Minimize streaking by washing the siding from the bottom to the top. Otherwise, the streams of solution racing down will leave hard-to-remove streaks. Rinse the opposite way—from top to bottom. Yes, pros often do just the opposite, but if you don't do this for a living and don't have the equipment and experience to move very quickly, follow our advice. Don't overlook the bottom edge of lap siding, soffits or anywhere that dripping water can cause a buildup of dirt.

To clean aluminum siding, use trisodium phosphate (TSP) and warm water. Use a soft brush and don't scrub so vigorously that you remove the finish. For vinyl siding, gentle scrubbing with some warm water and a little dishwashing liquid should do the trick.

For mildew-covered siding, try a product like Jomax House Cleaner and Mildew Killer. It's added to a solution of warm water and bleach and applied with a garden sprayer. It can often remove dirt and mildew without scrubbing.

8 ASPHALT DRIVEWAY

Do yourself a favor—tackle this job in the morning, while it's still cool. Use a broom and a leaf blower to remove leaves and dirt. You've been waiting for a good use for those old recip saw blades you can't part with. Here's one: Use them to rake weeds and dirt out of cracks. Mix up some general household cleaner, such as Spic and Span, in a bucket with warm water, and scrub with a stiff-bristled broom. Rinse well with a garden hose. To keep out weeds, fill cracks with asphalt crack sealer.

9 FENCES AND DECKS

If you're well experienced with a pressure washer, you can carefully work your way over the surface with a 25-degree spray nozzle. For the inexperienced, scrubbing by hand is more likely to clean, not splinter, the wood.

Before you begin, thoroughly rinse nearby siding, trim and doors using a garden hose and spray nozzle. Wetting these surfaces prevents debris from sticking to them. Next, mix 1 cup of TSP, 1 cup of liquid bleach and 1 gallon of warm water. Work a small area, then rinse before moving to the next, to ensure uniform cleaning.

10 LAWNMOWERS

If you've come this far, a little more cleaning won't kill you. Dried clippings block airflow above the mower's deck and hold moisture below. Brush them off the deck and from between the engine's cooling fins. Disconnect the lead from the spark plug, tip the mower on its side and scrape under the deck with a putty knife, and then rinse it with a garden hose. Tip the mower down; remove the engine shroud and vacuum the area clean with a shop vacuum. Remember to reattach the plug wire, though, or you'll never get that mower to start. **PM**

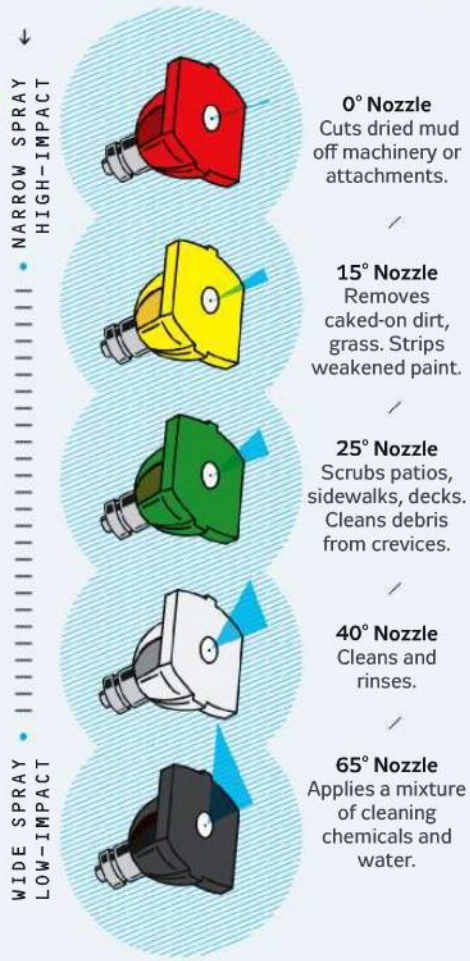
NOW YOU KNOW

Nozzle Knowledge

For jobs around the house and yard, a pressure washer that operates at 1200 to 3000 psi is all you need. It's light-duty compared to those that operate at 4000 or higher, but it's still got enough power to do damage or cause injury. To use it correctly, first choose the right color-coded nozzle.

Do: Wear long pants, gloves and protective eyewear.
- Hold the nozzle 6 inches to 1 foot above the surface, or per the manufacturer's directions.

Don't: Spray against glass windows or doors or direct the spray upward when cleaning lap siding or sidewall shingles.
- Spray against electrical meters or network boxes for phone or cable service.



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SMART HOME

THE KEYS TO LOWERING CONSUMPTION LIE IN A HOUSE'S SYSTEMS. THESE 11 NEW TECHNOLOGIES, SELECTED AS POPULAR MECHANICS GREEN DESIGN AWARD WINNERS, CREATE MORE EFFICIENT BUILDINGS AND MORE EDUCATED INHABITANTS. BY HARRY SAWYERS

THE TIGHTWAD TOILET

Toilet technology is a little like limbo—how low can you flow? The bar now sits at 1.28 gallons per flush. But Niagara's Stealth toilet sips only 0.8 gallons per flush thanks to a dual trap system that uses an air-transfer valve to pressurize the trapway, requiring less water to get something that early, primitive low-flow toilets lacked: "nice, complete rim cleaning," says Niagara's Paul Kwiat. Pressurized air replaces water in the trap as the tank fills. As the fixture flushes, the air travels up into the tank to displace the water in a tiny torrent to the bowl.

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SMART HOME

POPULAR MECHANICS GREEN DESIGN AWARDS

← GET IN ON THE GRAYWATER

Most graywater draining from a sink or shower can be reused, with a little scrubbing, as garden irrigation. Few systems accomplish this task as simply as the one from US HydroTech, which pumps graywater through layers of filtration media to clear the water of soap and debris without chemical treatments. Developer Ed Bertain claims the system can handle up to 69.3 gallons per person, per day. Combine it with a collection tank, which can also be set up to catch rainwater.

↑ THE REEL DEAL

Dual gears store energy the way a flywheel does in the blades of Fiskars' new Momentum mower, which devours debris that would jam a typical reel. The blades also stay sharper—revolving and stationary blades often collide on each turn, but these work like scissors, passing each other at 0.003 inches. Clever blade-spool design lets the mower flush-cut edges typically trampled beneath the wheels.

↓ SYCAMORE SYRINGE

The Deep Drip 1-inch-diameter stake delivers water and fertilizer where they're needed: to tree roots, via a perforated hollow spike hammered 2 feet into the soil surface. A study by Cal State–Fresno's Center for Irrigation Technology found the stake to be more effective than surface water at saturating the root zone while reducing runoff and soil erosion.

↑ GREENER CLEANER

Made using nontoxic ingredients in a secret Manhattan lab, Green Depot's home-brewed cleaners reduce ecological impact as well as elbow grease. The recipe for the window cleaner eschews ammonia and alcohol in favor of "completely biodegradable surfactants," and the tub and tile cleaner works its fume-free magic through the power of a low-pH organic salt.

PHOTOGRAPHS BY KARL JUENGEL/STUDIO D; ILLUSTRATION BY ANDREW RAE

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SMART HOME

POPULAR MECHANICS GREEN DESIGN AWARDS

→ SUPER CAULK

This spray-foam latex seals gaps too big for caulk to fill. Installers use a gun rigged to a mixing machine to blast Energy Complete into framing transitions, such as where plates and joists meet. And while caulk loses its hold under pressure changes, latex permits a bit of building movement—enabling it to withstand the big bad wolf of blower-door tests. Plus, it installs faster than "a guy with just a little tube," Owens Corning's Karel Czanderna says.

↗ COOL, DARK ROOF

New Solaris shingles from CertainTeed match the 40 percent reflection rate of a light-colored roof, but look like a dark one. The difference is in the titanium dioxide. The reflective coating encases each granule; spot-coating, the norm, leaves a white sheen. "We've been selling roofs on curb appeal for 20 years, and people heard us—nobody wants white," the company's Lucas Hamilton says.

← PETRIFIED OSB

"Oriented-strand board is just such a gorgeous product," TorZo's Chris Coduto says, "but if you want to rout an edge in it for a countertop, it tends to splinter." TorZo's solution is to place the structural panels in a heated vacuum, "polymerizing" the material so that it's firmer than a tropical hardwood. The result, named Orient, comes in four hues and can be shaped into OSB countertops, cabinet fronts, wainscoting or flooring. Installers fasten it with a two-part Corian adhesive (or just wood glue), then seal it with a clear coat. This process takes a basic building product and redefines its purpose.

↑ LED UPGRADE

Power-tool flashlights, not always the crown jewel of the combo kit, can get an efficiency boost with Milwaukee's Upgrade to LED. Switching the bulbs triples the run time on most 9.6-volt to 28-volt tools, and the 50,000-hour LED has 250 times the incandescent's life span.

→ WONDER WINDOW

Solera's opaque exterior panels contain nanogel polymers, weightless beads filled with air, that form a lattice through which no heat flows. As a skyscraper's curtain wall or a privacy wall in a house, the panes' R-17 to R-20 insulation—on par with a wall's—"dramatically reduces the heating and cooling load of a glass building," Solera's Avi Bar says.

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SALVAGE SCAVENGERS

The main challenge of using second-hand building materials? Navigating the salvage yards to find what you need. Kansas City's PlanetReuse acts as your scrap agent, sourcing anything from ex-ocean-boardwalk lumber to brick from an abandoned factory. The matchmakers pair materials requests with new online listings in an operation so streamlined that the firm can often price salvaged items for less than an equivalent new material. Good thing—they don't mill it like they used to.

PHOTOGRAPHS BY KARL JUENGEL/STUDIO D; NICK FERRARI (SUPER CAULK); MARKO METZINGER/STUDIO D (COOL, DARK ROOF); ILLUSTRATION BY ANDREW RAE

TWISTS ON SOLAR

CLEVER WAYS TO CATCH THE SUN EMERGE AT THE SOLAR DECATHLON, A BIANNUAL CONTEST IN WHICH COLLEGE STUDENTS DESIGN AND BUILD A SOLAR-POWERED HOME. THREE DETAILS FROM THE 2009 HOMES GET EXTRA CREDIT FOR CREATIVITY.

SOLAR LOUVERS

UNIVERSITY OF LOUISIANA AT LAFAYETTE

The Ragin' Cajuns' BeauSoleil home has a transitional breezeway, or dogtrot, capped by a complex skylight. Polycarbonate panels sandwich the skylight, which houses flat-plate solar thermal collectors and aluminum fins that function like stationary louvers on exterior shutters. Fins shade the porch from the sun as solar thermal collectors threaded through the metal provide domestic hot water.

REFLECTIVE GREEN ROOFING

PENN STATE UNIVERSITY

On top of Penn State's Natural Fusion home, cylindrical photovoltaics combine with a green roof. The tube-shaped "panels," made by Solyndra, take advantage of reflective roofing by collecting solar energy from 360 degrees. Green roofs reduce a building's rainwater runoff and lighten its cooling loads, but the Nittany Lions realized that plants could also bounce sunlight back into the panels—fusing technology and nature to create a new building-design technique.

SMART SHADE

UNIVERSITY OF MINNESOTA

The photovoltaic-clad roof gable on the Golden Gophers' Icon house extends to shelter its eastern porch beneath a translucent solar array. Silicon film on both sides of the bifacial panels captures sunlight from above and reflected light from below. An example of the design category known as building-integrated photovoltaics (BIPVs), this capitalizes on the pleasant, efficient shading effects of a porch awning by putting it to work generating power.

ON THE WEB > For a full list of Popular Mechanics Green Design Award winners, visit ***popularmechanics.com/greenliving.***

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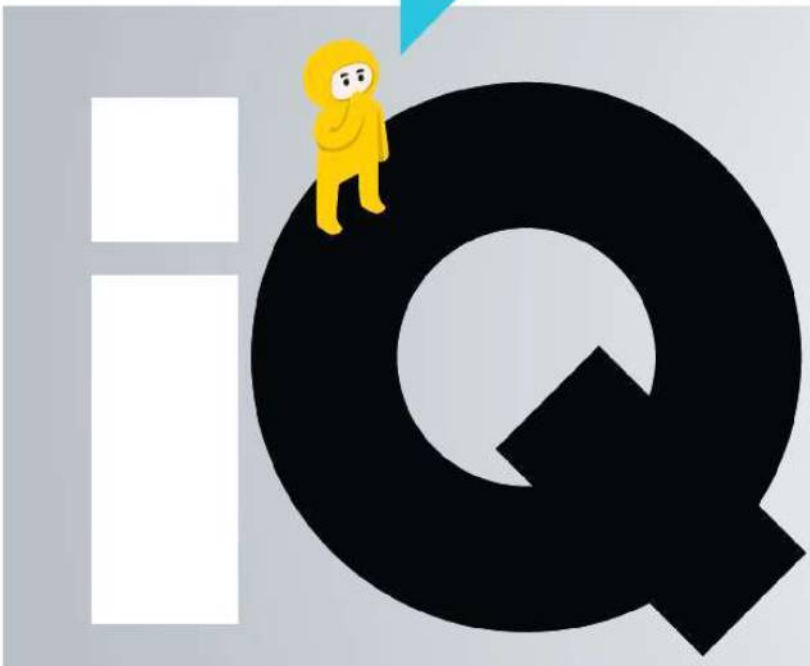
TEST YOUR DIY



So, you know how to build, fix or customize anything, huh? We'll see about that.

Valedictorian. Honor roll regular. Magna cum laude. After graduation, those accolades don't mean much if you can't answer the central question of adulthood: Can you fix that thing?

Of course you can. You read POPULAR MECHANICS. So this quiz—an objective evaluation of your home and automotive abilities—should be a breeze. You can eyeball a perfect mulch mound from across the yard, you anticipate oil changes like you have an internal odometer, and you can cement PVC pipe in your sleep. Right? Carve a fresh edge into your carpenter's pencil and let's find out.

BY HARRY SAWYERS

PHOTOGRAPH BY JAMES WORRELL

1. You just poured a concrete slab for your new patio, and you have an itch to wheel out the grill. To get wet concrete to cure properly, you should:

- A. Expose it to sunlight
- B. Sprinkle it with silica gel
- C. Put a fan on it
- D. Cover it to keep it moist

2. Six pieces of information appear on a tire sidewall label that reads P245/40ZR18. P means "passenger car," 245 is the width of the tire (in mm) when mounted, and 18 is the diameter of the rim in inches. Which of the following is *not* indicated by the 40, Z and R in the middle of the code?

- A. Aspect ratio
- B. Optimal air pressure
- C. Speed rating
- D. Construction

3. You're always on your ladder, either keeping the gutters spic-and-span or rescuing local cats trapped in trees. So you know the rung rules: Which ladder step is safe to stand on?

- A. Top cap
- B. Rear step
- C. Top step
- D. Second step

4. Some recent experimentation with gas-saving gadgets gave you a pleasing, placebo-charged feeling of success, but the numbers didn't show any fuel savings at all. Changing your driving behavior is more likely to get the results you seek. Which of the techniques below will actually improve your fuel economy?

- A. Increasing tire pressure
- B. Accelerating more gently
- C. Turning off the a/c
- D. All of the above

5. After spending a year in the woods building your midlife crisis cabin with an axe and mallet, you're ready to return to the world of power tools. Which of the following saws' blades should *not* be moving when it makes contact with the material to be cut?

- A. Chain saw
- B. Circular saw
- C. Miter saw
- D. Reciprocating saw

ILLUSTRATIONS BY **SPLITINTOONE**

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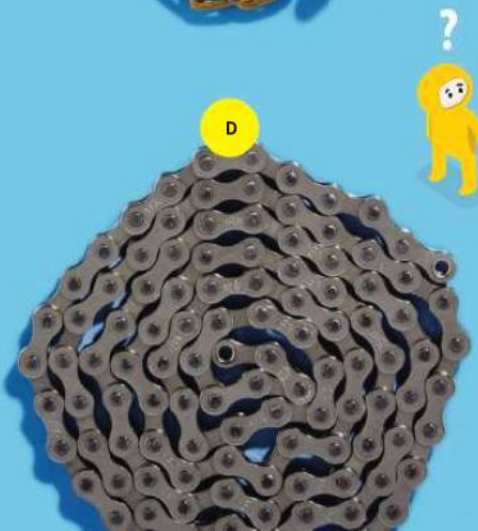

6. Of the four chains at left, only one can successfully be used as a "drop chain" to help snake wiring behind walls. (Hint: It's a link to the past.) Name that chain.

___ A. Snow-tire chain
___ B. Window sash-weight chain
___ C. Chain-saw chain
___ D. Bicycle chain

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7. You want to insulate the attic, and you're fairly hip to the latest in high-tech heat retention. Fiberglass batts have a thermal resistance rating (or R-value) of 3.1 to 4.3 per inch, and higher R-values mean better efficiency. How do new products compare to the big pink? Identify the insulation with the highest R-value from the list below.

- A. Mineral wool
- B. Cellulose
- C. Polyurethane spray foam
- D. Recycled blue jeans

8. The hammer is your primary problem-solving tool—you're just that type of craftsman. When hammering machined surfaces or fragile parts, which type of tool is inappropriate to use?

- A. Lead hammer
- B. Ball-peen hammer
- C. Brass hammer
- D. Rawhide hammer

9. You're laying a floor that will be used regularly to host plus-size stiletto square-dancing night. You need the hardest wood available—which of these is your material of choice?

- A. Maple
- B. Cherry
- C. Hickory
- D. Bamboo

10. You're pressure-washing the patio with a 40-degree nozzle, moving the tip side-to-side in a slow sweep about a foot from the concrete. But stains under the bird feeder aren't coming up. For more power and a focused beam, which nozzle size do you need?

- A. 15-degree nozzle
- B. 60-degree nozzle
- C. Third-degree nozzle
- D. No nozzle; just put your thumb on the hose tip

11. You're convinced that modern paint chemistry is a conspiracy—the low-VOC trend, in particular, rouses your suspicions—so you prefer to use a traditional oil-based alkyd whenever possible. Which job is ideal for an oil-based paint, rather than a new latex acrylic?

- A. Interior drywall
- B. Exterior stucco
- C. Exterior ironwork
- D. Interior woodwork

12.

You spread mulch because you think it's pretty, but you don't like to admit that to your rugby pals. It's practical, you say—when spread around shrubs, mulch retains moisture, inhibits weed growth and keeps roots from overheating. To maintain your cred in the scrum, when should you apply mulch, and how much of it?

- A. Apply liberally in spring—can't have too much of a good thing
- B. Sprinkle less than 2 inches when the heat hits 85 F
- C. Spread 2 to 4 inches over cool, moist soil in springtime
- D. Real men don't mulch

13. The cheapo lug wrench that the manufacturer threw in the trunk is demonstrating its shortcomings—it won't loosen the tire's lug nuts. What's the best way to get the stuck nuts moving?

- A. While holding the wrench steady on a nut, kick the tire to depressurize the fastener
- B. Fit the wrench on a nut, slip a 3-foot pipe snugly over the wrench end, and pull the pipe end counterclockwise
- C. Turn the wrench clockwise; stuck lug nuts are often reverse-threaded
- D. Hold the wrench on a nut while a helper quickly drives the car in reverse

15. When the local GM dealership liquidated its inventory, you scored a compressor almost as big as a Buick. The 60-gallon beast runs at 3 hp and blows an average of 10.2 cfm at 90 psi. Still, it's limited—which of these tools could it *not* power?

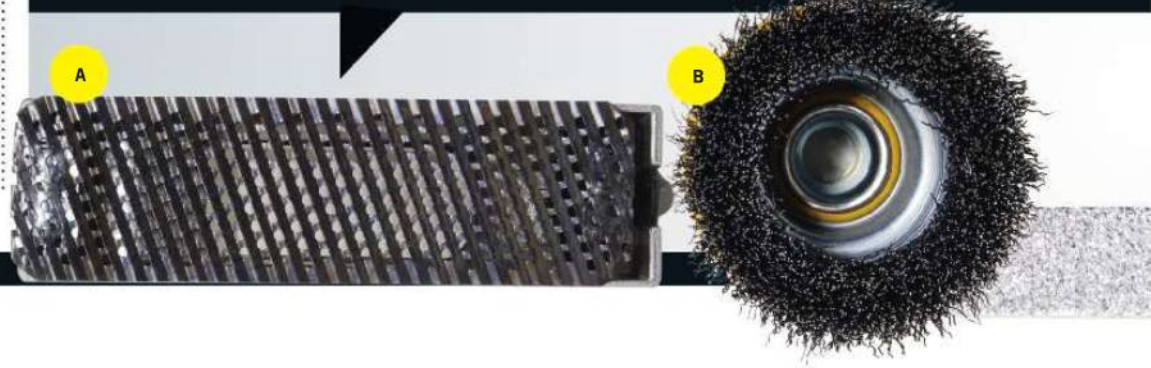
- A. Brad nailer
- B. 3/8-inch impact wrench
- C. Orbital sander
- D. Finish nailer

16. Winston butts that visiting kinfolk stomped into your old oiled pine floors have left some unsightly blemishes over the years. To patch a damaged section, you cut out a sooty spot with a plug-cutter, fashion a matching plug to fit it, sand it flush and oil the area. The repair you've made is called a:

- A. German repair
- B. Scotsman repair
- C. Dutchman repair
- D. Myanmarman repair

14. The world of abrasives doesn't start and end with sandpaper. The following tools can reshape surfaces in a hurry—but only one item has the scour power to take rust off ferrous metal parts. For coarse credit, which is it?

- A. Drywall rasp
- B. Carbon-steel wire cup brush
- C. General-purpose mill file
- D. Ceramic and marble file



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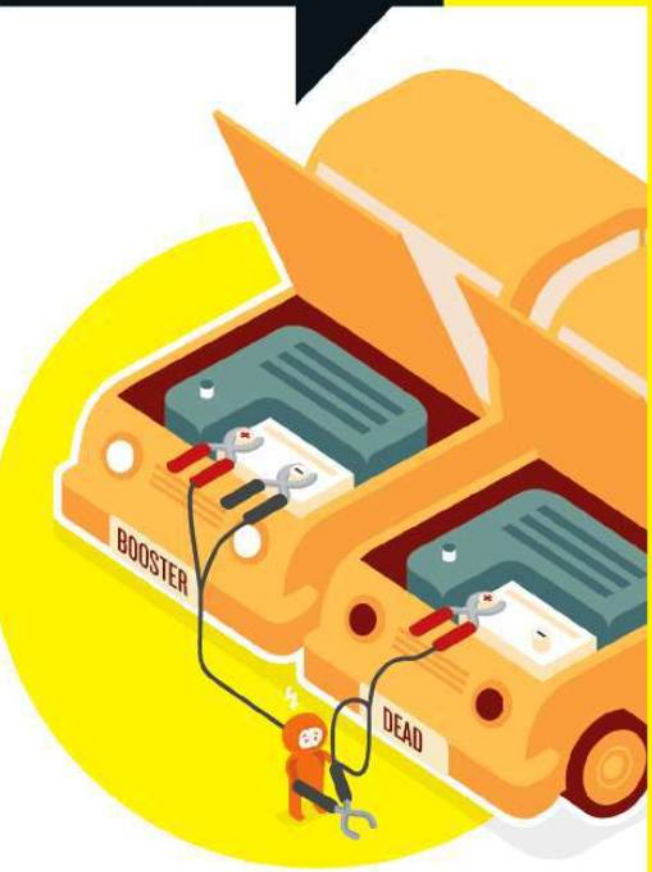
what to do?

17. Your truck is dead in the driveway and needs a jump. So you hook the red cable to the positive terminal of the dead car, repeat for the booster, then connect the black cable to the negative terminal of the booster battery. Where should the final black wire's clamp be connected?

- A. Dead battery's negative terminal
- B. Dead vehicle's engine block
- C. Dead battery's positive terminal
- D. Leave it loose for good luck



18. The neighborhood tetherball league is gearing up for a new season, and this year you want to build a home pole to practice in private. You're digging a hole for a 4 x 4 post that will rise 8 feet above grade, set in ready-to-mix concrete. The 4 x 4 is 12 feet long. How deep and wide should the post's hole be?

- A. 4 feet deep, 1 foot wide
- B. 4 feet deep, 4 inches wide
- C. 2 feet deep, 6 inches wide
- D. Just dig until you're tired

19. Clearly, the lumberyard is out to cheat you. The measurement listed on your boards isn't the same as the dimensions you find by putting a tape measure to each stick. A 2 x 4, for example, measures as 1.5 x 3.5 inches—the big numbers are "nominal" dimensions, the sawyers say. So if you're at this shady lumberyard buying a nominal 2 x 8, how big is that board in reality?

- A. 2 x 8
- B. 1.5 x 7.5
- C. 1.5 x 3.14159265
- D. 1.5 x 7.25

20. After shaping the edges of soft, nonferrous metals, the teeth on your single-cut file become clogged with metal shavings, prohibiting a smooth finish. The tool you use to clear out the file's teeth and keep it cutting properly is called a:

- A. File card
- B. File pick
- C. File driver
- D. File solution

21.

You've been putting off the chore long enough—today's the day you finally buckle down and build your potato cannon. After cutting the PVC pieces to size and cleaning the ends you plan to join, what's the next step?

- A. Apply purple primer to the male end and PVC cement on top of that. Wait 5 minutes, repeat for the female end, then fit them together
- B. Dry-fit the pieces and fire a test potato
- C. Brush primer onto the inner rim of the female end and the outer rim of the male end. Apply PVC cement on top of the primer. Fit the ends together immediately
- D. Apply purple primer to each end, wipe it off, slather PVC cement to the ends, wipe it off, and then fit each piece together

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what's that?

25. Your shop wouldn't be complete without this automotive tool, which can separate the ball joints, tie rods or pitman arms from a suspension upright (aka the knuckle). What is the tool's name?

— A. Pickle fork — B. Sausage fork — C. Onion fork — D. Bacon fork

22. Conversing with the gentlemen at your local back-street drag race, you claim that your modified Corvette's supercharger is superior to a rival's Nissan GT-R turbocharger. What's the difference between a supercharger and a turbo?

— A. There is no difference
— B. Superchargers produce more power
— C. Exhaust gases drive a turbo; superchargers run off the crank, like alternators
— D. Only superchargers use ultracool air from the climate-control system

23. After years of yanking loose branches from the yard's treetops with a frayed extension cord, you've learned that you may be using the tool unsafely—especially when it's also plugged in. According to the National Fire Protection Association, which of the following is an appropriate use of an extension cord?

— A. As permanent wiring concealed under floors or behind walls
— B. As wire tied to an overhead pipe in the basement shop
— C. As a power source for a toaster, heater, coffeepot or any other electric heating appliance
— D. As 120-volt service through a grounded three-prong outlet to power a non-heat-producing appliance

26. If this wall is load-bearing, which way does it run in relation to the direction of the joists?

— A. Perpendicular
— B. Parallel
— C. Backwards
— D. There's no hard-and-fast rule

27. A pair of white wires dangles from this installed outlet. What connection is broken?

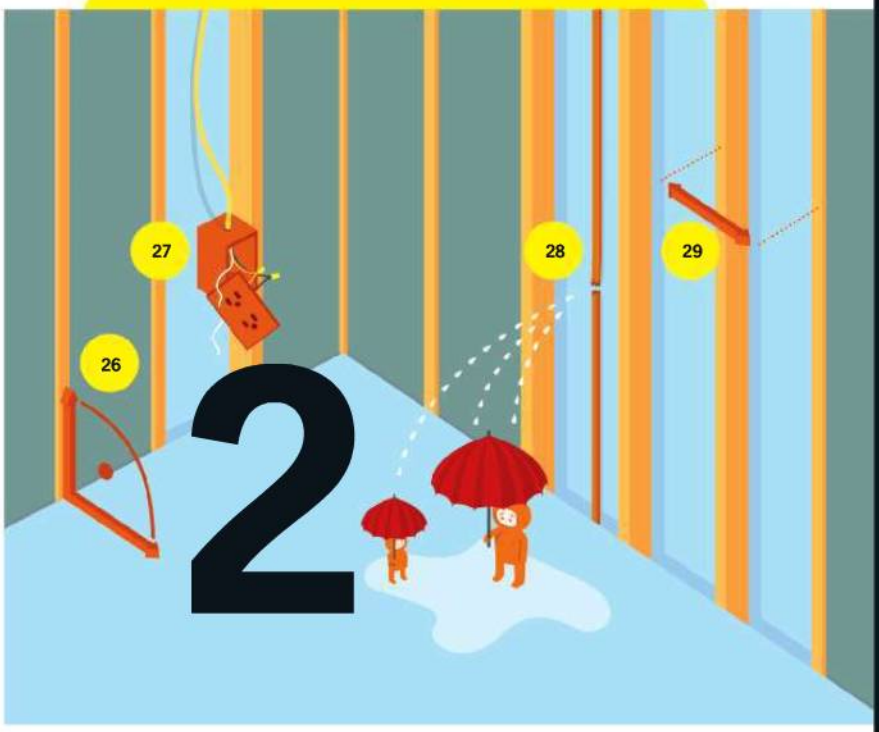
— A. Hot wire
— B. Neutral wire
— C. Ground wire
— D. Tripwire

28. When installing a medicine cabinet, you went a little wild with the Sawzall and cut this pipe. What type of fitting can reconnect it?

— A. Bushing
— B. Adapter
— C. Coupling
— D. Flange

29. What is the typical distance on-center between studs?

— A. 12 inches
— B. 16 inches
— C. 24 inches
— D. One pace



24.

You love relaxing at Jiffy Lube, but fear you're wearing out your welcome. Maybe you're overdoing the oil changes. How often should you replace old oil?

— A. Every 3000 miles — B. Every 5000 miles — C. Every 7500 miles — D. As often as the owner's manual says

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what's that?

30. Your old house's walls are out of square, making this woodworking tool—which can measure, copy and mark any angle—an indispensable gauge. Every craftsman owns one, but rarely will two identify it by the same name. Whatchamacallit?

— A. Sliding bevel square
— B. T-bevel
— C. Adjustable bevel square
— D. All of the above

31. Your serpentine belt's looking rough, and any day now you expect to find it lying detached in the driveway. How do you know when it's time to replace a serpentine belt that's grown long in the tooth?

— A. Replace it when you change your oil
— B. Change it when you rotate your tires
— C. Replace it when the surface scales and it begins to fray
— D. A decent serpentine belt should last forever

32. You're trying to learn the names of your ramshackle Victorian's fancy carvings so you can navigate the millwork catalog without just tracing the profile and hoping you order the right replica piece. Last time, corbels came instead of crown molding. Which of the following is *not* the name of an actual house part?

— A. Mullion
— B. Tympanum
— C. Festoon
— D. Nasturtium

33. It's tough to remove a roll pin that has rusted in place over the years. These pins lock gears and levers to a shaft such as a clutch cable arm. To get a stubborn one to budge from its position, you should:

— A. Use a roll-pin punch nearly as big as the pin
— B. Drill it with a high-speed-steel bit the same size as the pin
— C. Use a roll-pin punch about half the pin's diameter
— D. Lube it in WD-40 and extract it with a rare-earth magnet

35. You and your beloved circular saw have been through thick and thin ... lumber. But which material can *not* be cut using a circular saw fitted with a wood-cutting blade?

— A. PVC molding
— B. Oriented-strand board
— C. Medium-density fiberboard
— D. Fiber-cement siding

36. You're modifying a scrap 2 x 4 to replace a rotten deck-rail spindle. Cutting the lumber with handsaws, you're tackling its long edge before trimming to length. In the correct order, which two saws do you need?

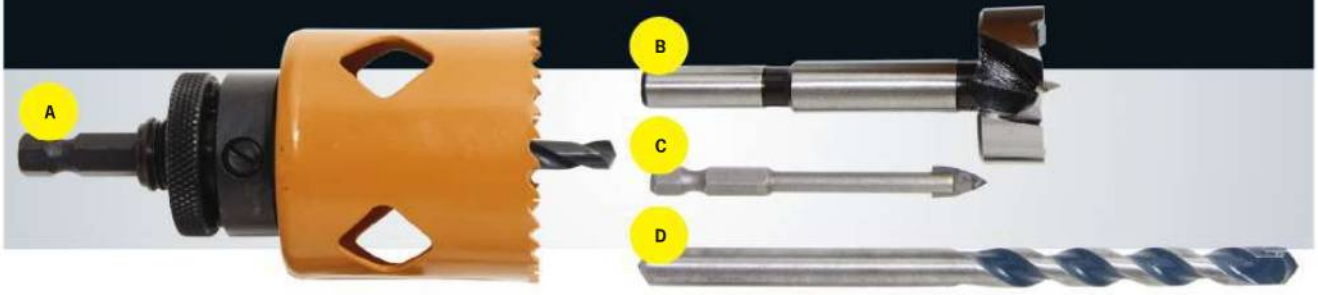
— A. Crosscut saw, ripsaw
— B. Hacksaw, ripsaw
— C. Ripsaw, chain saw
— D. Ripsaw, crosscut saw

37. After struggling to remove a tire, you want to make the nuts easier to turn next time. What tool turns lug nuts to the ideal tightness when mounting a tire?

— A. Pneumatic wrench
— B. Breaker bar
— C. Torque wrench
— D. Tire iron

34. These bits put holes in brick, glass, metal and wood—but only one of these, sized 1⅜ inch in diameter, is the perfect tool to install invisible European Soss-style hinges on cabinet doors. Which bit is it?

— A. Bimetal hole saw
— B. Forstner bit
— C. Carbide-tip bit
— D. Masonry bit



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TEST YOUR DIY iQ
ANSWERS

1. D Concrete doesn't dry—it cures via a chemical reaction between cement and water. The reaction takes place over five to seven days, during which time it's critical to keep the fresh pour covered and moist. Stake a tarp over the patio and mist the slab once every 24 hours.

2. B Air pressure recommendations appear on the driver's side doorsill or in the owners' manual, not here. The only psi number on the tire is the *maximum* air pressure—not a *recommended* level.

3. D Second step down from the cap.

4. D Increasing the tire pressure reduces the rolling resistance. Going easy on the gas provides an efficient throttle input. And a/c requires engine power to run, reducing fuel economy.

5. D Hacking at an old gutter with a moving reciprocating-saw blade just might knock you off a ladder. Instead, wedge the saw's blade and shoe firmly against the material before pulling the trigger. Get the other saws' blades spinning at full speed before carefully making contact with the workpiece.

6. B Window sash-weight chains' flexible links and low heft make them ideal to snake wires down stud bays.

7. C Polyurethane insulation materials typically have an R-value of about 7.0 to 8.0 per inch, and rigid polyurethane panels with foil facings can get up to 8.7 per inch. With an R-value of 3.0 to 3.8, loose-fill cellulose ranks near fiberglass batts. Same goes for shredded blue jeans, with a 3.4 to 3.7 R-value, and for mineral wool, about 3.7.

8. B Ball-peen hammer. The ball-peen—and not your old carpenter's framing hammer—is appropriate for striking chisels, punches and other hardened metal. Use softer faces like lead or brass for delicate work.

9. C Hickory is the hardest here, falling in at 1820 on the Janka hardness scale. Cherry is at 950, bamboo measures 1380, and maple scores 1450.

10. A The 15-degree nozzle's narrow spray can cut caked mud off the lawnmower and strip weak paint from brick. The wider, gentler, 60-degree spray can apply mixtures of cleaning chemicals and water to weathered decks and wood siding.

11. C Acrylic paints are superior to alkyds—except on exterior ironwork. Scrape away loose paint and rust, apply a fish-oil-based primer, and clean with mineral spirits.

12. C Overdoing mulch actually stresses the plant—pile it 2 to 4 inches high, and avoid burying the plant's root stem. Apply mulch in cool late spring to give the plant's roots insulation against the first hot sunshine.

13. B The problem with those cheap lug wrenches is that the short handle gives the user little leverage. The pipe extends the handle and increases the user's mechanical advantage over the nut the wrench is turning.

14. B Carbon-steel brushes like this one work on ferrous metals, but can introduce rust and contamination to stainless steel.

15. C At up to 11.3 cfm at 90 psi, the orbital sander's continuous draw may overtax this machine during extended periods of use. The compressor can handle the ½-inch impact wrench (2.5 to 3.5 cfm at 90 psi), the framing nailer (2.2 to 5.0 cfm at 90 psi) and brad nailers (0.3 cfm to 1.3 cfm at 90 psi).

16. C Dutchman repairs often stand in contrast to the surrounding flooring, and on historic floors exposed to years of wear, it's not uncommon to see several such patches. The aesthetic is so distinct that some engineered flooring manufacturers have built faux Dutchman repairs into the finished product when replicating historic styles.

17. B Connect one end of the positive (red) cable to the positive (+) terminal on the battery of the dead car, then repeat for the booster car. Connect one end of the negative (black) cable to the negative (–) terminal on the booster battery. Then connect the other end of the negative (black) cable to a clean, unpainted metal surface (such as the engine block) on the engine of the disabled vehicle.

18. A According to Quikrete's *Build and Repair With Concrete* (the edition with a sneering, troweling Don Knotts on the cover), the diameter of a posthole should be roughly three times the post diameter. Hole depth should be one-third the overall post length. Ergo, drop this 12-foot 4 x 4 in a hole 1 foot wide and 4 feet deep, leaving 8 feet of tether post exposed.

19. D The 8-inch nominal dimension actually measures at 7¼ inches. The difference occurs because the nominal dimensions typically refer to rough lumber, the size of which declines as the boards are planed and dried.

20. A File card.

21. C The cement will begin setting immediately, so have each end primed and ready before beginning the cement slather. PVC is easy to glue—no flame, no flux—but don't dawdle.

22. C Both the turbo- and supercharger are pumps that force more air into the engine. Increased air adds oxygen to the intake charge, producing more power. Turbos have a compressor and turbine wheel connected by a shaft—the exhaust gases spin the turbine, which drives the compressor. Superchargers, however, have only a compressor, which is powered by some connection to the crank, usually a belt.

23. D Not only are choices A through C off-limits, but if that outlet doesn't have the third grounding connection, code states that you can't even grind off the cord's third prong. Install a new outlet. And use rope to wrangle dead wood.

24. D Modern engines typically outlast the rest of the car as long as the manufacturer's service schedule is followed. So do what the book says, but remember: Commuting in stop-and-go traffic is considered "severe" duty.

25. A The pickle fork's forged tines will separate the tie rod ends from the suspension, either by hammering the handle or attaching the handle to an air hammer.

26. A Load-bearing walls in the central part of the house run perpendicular to the joists. Exterior walls and most stair walls are also load-bearing.

27. B Neutral wires are white.

28. C Couplings continue a straight run in pipe or tubing, joining pipes of like sizes or, with a reducer coupling, mating two different diameters.

29. B Sixteen inches.

30. D The multi-monikered hand tool is critical when installing interior trim. Measure the angle between two walls by pressing each leg against the wall surfaces, lock in the setting, then transcribe the findings to the miter saw and cut the trim.

31. C Depending on the belt, the signs of old age include surface cracking—think of the surface of a dry lakebed—and fraying like an unraveling sweater. Modern serpentine belts should last 10 years and 100,000 miles.

32. D The mullion is a vertical member separating two casement windows, the tympanum is the recessed triangular face of a pediment, the festoon is a decorative fruit or floral carving often found on a frieze, and the nasturtium is an edible flower.

33. A Using a roll-pin punch that's too small will flare the end of the pin and make it even harder to move. The metal in the pin is so hard that it'll only melt the drill bit. The right punch is nearly as big as the pin. With the punch's dimpled end centered on the pin, smack the tool smartly with a ball-peen hammer to drive the roll pin out.

34. B For Soss hinges, use a Forstner sized 1⅜ inch, or 35 mm.

35. D The blade to cut fiber cement has a tooth geometry unlike the serrated edge of a woodcutting blade. Instead, it only contains about four or five teeth, often made of a high-density carbide and capped with a nonstick coating. Woodcutting blades are perfect for OSB and MDF, and they're passable for PVC.

36. D Ripsaws work like a series of chisels to scoop out material in line with the woodgrain. Crosscut saws sever the wood fibers at each edge of the blade, then the saw teeth scoop out the sawdust in the saw blade's channel, or kerf. On a 2 x 4, the crosscut saw works across the short side, while the ripsaw cuts along the board's length.

37. C Tightening the lug nut fractionally, with a torque wrench, lengthens the wheel stud. This maintains the proper clamp force on the wheel. Overtighten the nut (likely with a pneumatic wrench) and you risk exceeding the bolt's yield point, which weakens the metal. Too loose, and the wheel could fall off. **PM**

MAKE THE GRADE

If you correctly answered ... then you are:

1 to 9	Dangerous with a drill
10 to 18	Flirting with competence
19 to 27	Able to work unsupervised
28 to 36	Admirably handy
37	Ready for Wrench Mensa

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DIY TECH

Wall Mounting a Flat-Panel HDTV

IT LOOKS LIKE A FRAMED WORK OF ART. WHY NOT HANG IT LIKE ONE?

By Glenn Derene

Hanging a flat-panel LCD or plasma television on your wall is a simple project that can be accomplished in about an hour. But, once you're done, it takes a surprising amount of faith to step back and leave a $1000 to $5000 piece of electronics perched above the floor—suspended only by the quality of your workmanship.

My own fear of the devastating effects of gravity kept a 37-in. LCD TV sitting on my floor for months. I could have paid a professional installer to hang the set, but I knew I had the skills and tools to do the job myself. It just took a while to muster the courage.

Obviously, TVs don't hang on picture hooks, so if you decide to do this project, you need to get a wall mount. All mounts have a weight rating, and the first thing you need to determine is how heavy your set is. In general, LCD sets weigh less than plasmas of the same

Hanging a TV is easier than you may think. During the actual installation, tech editor Glenn Derene, above, got help from a friend—and they both wore shoes, not flip-flops.

PHOTOGRAPHS BY **CHAD HUNT**

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size, but no large TV is light: Expect a 42-in. LCD television to be 45 to 60 pounds, while a 42-in. plasma will tip the scales at 80 pounds.

You'll also want to study up on the situation inside your wall. Hollow-wall anchors will not hold television mounts, so unless you've got a concrete wall where you can sink some anchors (decorative brick doesn't count) you're going to need to find the studs. Use a stud finder and mark off the center of the studs near where you'd like to mount your set. As a rule, TVs under 80 pounds and 40 in. can be anchored to a single stud. For anything bigger, use two.

Most mounts allow you to adjust a few inches to the left or right, but don't expect post-Newtonian miracles. Take a close look at where your studs will position the TV. Is it going to catch glare from windows? Is it clearly visible from all the seats in the room? My TV ended up a bit off center on the wall; such compromises are hard to avoid.

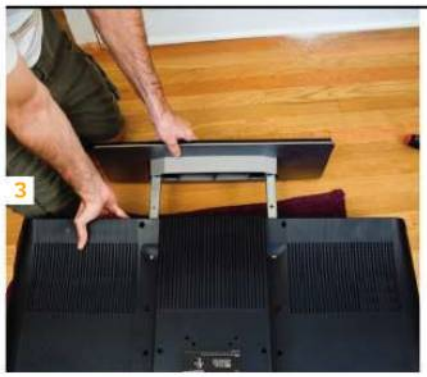
The best way to ensure a perfect fit is to buy a mounting kit from the manufacturer that built your set, but that's not always the most economical choice. Manufacturers such as Bell'O, Peerless Industries and Sanus Systems offer aftermarket mounts with various weight ratings that cost from $20 to $1200 and can be adjusted to fit most TVs. I went with a $70 Sanus MF202, which is sturdy and not too expensive, and is constructed with a ball-joint mechanism to allow for full-motion tilting.

Mounts are capable of some rather exotic articulations. Some models even have remote-control, extendable arms. As you move up the ladder in sophistication, though, expect the cost to go up and the weight rating to go down—the farther you move the set away from the wall, the more shearing force you put on the connection to the stud.

Mounts generally have two main pieces: One attaches to the wall, and the other to the back of the television. Use the wall bracket as a template to mark the position of your pilot holes. The hardware will require some pretty heavy-duty lagscrews, and you'll need a socket wrench and plenty of muscle to screw them into the studs. Before you torque down the final turns, check your work with a level—nothing ruins home theater more than an off-kilter TV.

To prep your TV, remove its stand, which probably is held in place by four screws in the back. If you're attaching an aftermarket mount, you'll have to do a little trial and error with the bolts and washers—the kit should include several sizes of each. Make sure to secure the bolts to the metal frame of the set. A television can have more than a dozen screws and bolts holding together everything from circuit boards to the plastic cover, and those are not components you want supporting the weight of your television.

Once both brackets are secure, have someone help you get the TV onto the wall—for really large TVs you might need three people. One person should spot while the other lifts. Mounts secure in various ways, but the basic idea is that the TV bracket clips onto (or slots into) the wall bracket. Confirm that everything is locked down, and give your TV a few light test tugs to make sure it's on tight. Then check back in about an hour. If your TV hasn't fallen by then, you probably put it up correctly. **PM**



1 /// Pick Your Spot Use a stud finder to locate the center of the studs of the wall that will hold your television.
2 /// Apply Some Torque Securing the wall bracket requires hefty lagscrews, a socket wrench and plenty of oomph.
3 /// Ditch the Stand You won't need a stand anymore, so unbolt it from the TV's frame.
4 /// Attach the TV Hardware A second bracket mounts to the TV. Universal kits come with several fasteners, to match every set.

ON THE WEB /// Shopping for a set? Separate HDTV myth from fact at ***popularmechanics.com/HDTVmyths***.

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A new oak handrail, glossy hardware and some wall and ceiling paint spruced up this entry.

Replacing a Staircase Handrail

SMALL CAN BE BEAUTIFUL WHEN IT COMES TO DIY PROJECTS—THIS UPGRADE WAS DONE IN A DAY.

BY JOSEPH TRUINI

I suppose I'm like most people when I consider home improvement ideas—I tend to think big: adding a master bedroom suite, building a multilevel deck, expanding the kitchen, replacing windows and doors, and other dream projects.

But over the years I've begun to realize that smaller, quicker projects can offer the greatest satisfaction—and the most impact for the money and time spent. For example, our current home has a beautiful red-oak formal staircase leading up to the second

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floor. But for some incomprehensible reason, the builder mounted a plain pine handrail to the staircase wall, which is totally inappropriate. It didn't match the traditional oak handrail on the adjacent balustrade at all.

That handrail bugged me for years, as I went about larger projects. The last straw came when the rail loosened and threatened to come off the wall entirely. When it became hazardous, aside from being ugly, I realized that it had to go, and the sooner the better. I replaced it with a far more attractive railing that enhanced the staircase instead of detracting from it. Here's how I did it.

Out With the Ugly

The old handrail was attached to the wall with three cast-aluminum brackets, and as if the rail itself wasn't ugly enough, the brackets were painted black. So, the first thing I did was grab my cordless drill/driver and start backing out screws. I first unscrewed the brackets from the wall at each end of the handrail *(1),* leaving the center bracket for last. That way, the weight of the handrail was evenly supported until I backed out the last screw. Being a thrifty guy, I saved the old handrail to use on the basement or garage staircase someday.

Next, I checked to make sure the old brackets had been screwed to wall studs by tapping a finishing nail into the old screw holes. In each case I hit a stud, and knew that I could attach the new brackets to the same framing. I could have used an electronic stud finder to locate the nearest stud, but the finish-nail method is fast and sure, even if it is low tech. (Note that you should never attach a handrail to drywall or plaster using wall anchors; it must be securely screwed to a wall stud or other solid framing.)

Also, don't take a shortcut by installing the new railing using the old screw holes. Spend a few minutes placing new holes to ensure a really sturdy installation. I simply used a level to mark short vertical lines onto the wall, leading up from the bottom screw holes left by the old brackets *(2)*. Then, I marked each of the three lines ½ in. up from the bottom screw holes and

REMOVE OLD HARDWARE

(1) Use a fresh screwdriver bit to avoid stripping the slots in the old screw heads, which would lead to an ugly removal job. *(2)* Mark up from the old locations with a level.

1

2

3

FASHION THE RETURNS

(3) Cut the short lengths of return and then cut the miter on the handrail itself. *(4)* Oak is tough stuff—don't even think of driving nails into it without first boring pilot holes. *(5)* Apply glue and nail the return.

4

5

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punched a small hole in the wall at each ½-in. mark using a nail set. These punch marks represented the locations of the bottom screws for the new handrail brackets. Moving the brackets up positioned the new handrail slightly higher than the old one, but it remained well within the recommended handrail height of 34 to 38 in. above the stair treads.

Next, I patched all the old screw holes with spackling compound. Once the patched areas dried, I sanded lightly with 120-grit sandpaper, spackled again, primed and painted. Since the handrail wasn't in the way, I painted the rest of the stairwell while I was at it.

Cutting the New Handrail

As a replacement for the pitiful pine handrail, I bought a handsome red-oak Colonial-style handrail at my local home center. It sounds high-end, but these attractive handrails are readily available and are usually located with other decorative wood products in the moldings aisle. And the new rail perfectly matches the oak handrail on the existing staircase balustrade. I paid $6 per foot for a 15-ft-long piece.

The finished handrail is only about 13 ft long, but I needed the extra length to make the mitered ends. Known as returns, these are surprisingly easy to craft. Each one consists simply of a short, 45-degree mitered piece of handrail that gets attached to the long piece, so that it forms a 90-degree angle. The short length returns back to the wall, providing a nice, clean, finished look.

To start, I used a power miter saw set to 45 degrees and cut a 3½-in.-long piece from each end of the handrail. Then, I cut opposing 45-degree miters on the handrail ends *(3)*, making sure the last cut trimmed the handrail to its finished length measured from one outside corner to the other.

Next, I attached the returns to the ends of the mitered handrail using glue and a pair of 2-in. (6d) finishing nails. Because oak is too hard to nail through, I first bored ⅛-in.-dia pilot holes *(4)*. Then I drove in the finish nails *(5)*. I tapped the nailheads below the wood surface using a nail set.

Once the mitered returns were attached, I sanded the handrail with a random-orbit sander, starting with a 100-grit disc and finishing with a 120-grit disc. (When sanding, don't forget to hit the sharp corners on the bottom of the handrail.)

After wiping off the sanding dust with a damp cloth, I used a foam brush to apply a coat of Minwax Polyshades, which is a combination oil-based stain and polyurethane varnish. You could just brush on some varnish, or apply one coat of stain, followed by varnish, but I like the combined convenience, look and cost of Polyshades ($12 per quart). Once the finish dried, I buffed the handrail smooth with superfine 0000-grade steel wool.

6

7

UPGRADE THE HARDWARE

(6) I chose glossy solid-brass railing brackets to set off the new rail. *(7)* Bore pilot holes into the handrail, then drive the brass screws through the strap and into the rail.

In With the New

The first step to installing a new handrail is screwing the brackets to the wall. Instead of reusing the old black-painted cast-aluminum brackets, I upgraded to a more elegant look and bought three polished solid-brass brackets that cost just $7 apiece.

Starting with the bracket located at the bottom of the staircase, I aligned the bottom screw hole with the reference hole punched in the wall earlier. I used a drill/driver to fasten the bracket to the wall stud with the three screws provided *(6)*. Then I moved on to install the bracket at the top of the staircase.

Now, before attaching the final bracket to the middle of the wall, I set the oak handrail on top of the two installed brackets. I screwed the U-shaped straps to the underside of the handrail, locking it onto the brackets, then installed the remaining hardware *(7)*.

Once the handrail was securely attached to the brackets at each end, I installed the final bracket to support the middle of the handrail. Note that three brackets are required for handrails longer than 8 ft.

The fresh paint and the new rail really dressed up the house's front entrance. I don't know why I waited so long—all it took was a few hours over the course of one weekend. **PM**

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Homeowners Clinic

by Roy Berendsohn

Q+A

TWO TOOLS

Simple hand tools quickly cut laminate to rough size.

Shears

- *Advantage:* Cuts straight lines and makes inside corner cuts. Little risk of breakage or cracking.
- *Disadvantage:* Slow.
- *Cost:* $30

Knife

- *Advantage:* Makes long straight cuts quickly.
- *Disadvantage:* Doesn't work well on inside corner cuts. Laminate can crack if replaceable blade is dull and laminate is not thoroughly scored before snapping.
- *Cost:* $10

The boomerang pattern is Formica's homage to 1950s industrial design and a reissue of a pattern it once produced.

Fabricating a Backsplash

Q Rather than cover the wall behind the counter with tile, I'd like to use plastic laminate as the backsplash in our kitchen. Can I glue it to the drywall? If not, how do I attach it? Everything I read about plastic laminate has to do with making countertops.

A Plastic laminate makes a great backsplash, but manufacturers recommend that you don't glue it to drywall. Instead, use a substrate such as particleboard or plywood that has at least one A-grade veneer face. There's a good reason for this: Adhesives work best on a clean, dry surface with a uniform texture. You're a lot more likely to meet these requirements with a sheet of new material than with the existing drywall, which is probably painted and, worse, coated with layers of dust and cooking grease. No matter how much you scrub, you can never remove those contaminants thoroughly enough to ensure a proper bonding surface.

I'd recommend that you start by making a paper pattern of the backsplash area and use the pattern to size the plywood panel. Cut the panel and test its fit. Now, cut a slightly larger piece of plastic laminate using laminate shears, or score and snap it to size with a laminate cutter. Spread laminate

STUDIO D; ILLUSTRATIONS BY GABRIEL SILVEIRA

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adhesive (not woodworker's glue or any other adhesive) on the back of the laminate and on the panel's face (the A veneer side, if it's plywood). Let the adhesive on both pieces dry. Next, place a row of ¼-inch-diameter dowel rods on the adhesive side of the panel and place the laminate in position on the rods. Slide the dowels out, and bring the two adhesive surfaces into contact. Press the laminate down firmly or work over it with a roller. Finally, use a router and flush trim bit to cut away excess laminate.

A few things to keep in mind. First, it takes some planning to conceal the panel's mounting screws and to ensure that the panel face is flush to the drywall. It's easiest to mount the backsplash before the cabinets are installed. That way you can hide the mounting screws behind the cabinets. Also, you have any number of patterns and thicknesses to choose from. There is a vertical grade of laminate, designed for backsplash applications, that is slightly thinner than laminate designed for horizontal counter applications. The vertical type is easier to cut.

Finally, if the backsplash is mounted over switches and outlets that are already installed in a drywall surface, you'll need a piece of hardware called a box extender. The extender is a sleeve that mounts over the electrical box, and it covers the gap created by the thickness of the backsplash panel. It's far easier to install an extender than to try and move the electrical box forward so that its edge is flush with the surface of the backsplash.

Carpet as Insulation

We're tearing out a houseful of carpet. Can we recycle any of it as attic insulation?

I wouldn't. Yes, it's likely that carpet would provide some insulation benefits, but it's also likely it will disintegrate from the intense attic heat. Besides that, if you go to sell the property someday, a home inspector will surely flag the "insulation," and the prospective owner will demand its removal.

Still, you're raising a question that lots of people are asking: Why isn't carpet more easily recycled? The carpet industry estimates that roughly 5 billion pounds of carpet end up in landfills each year. A nonprofit group called CARE (Carpet America Recovery Effort) has been formed to divert some of the waste stream and convert it into useful materials, such as decking, flooring, composite lumber and reinforcing fibers for concrete. There are carpet reclamation centers sprinkled around the country, but most are designed to take carpet from commercial sources, not homeowners. Furthermore, many of these companies charge from 5 cents to 25 cents a pound to take the material, which typically weighs 4 to 5 pounds per square yard.

If you manage to find a reclamation or flooring company that will work with you, don't just show up with a pickup-truck load. Some older carpets with jute backing are difficult to reclaim. "Your best bet is to bring in a small carpet sample and some padding first," advises Jeremy Krasny, owner of Western New York Professional Flooring in Cheektowaga, N.Y. And after all that effort, you may get a lucky break. "Usually we take it at no charge," Krasny says.

Leaking Skylights

My skylight leaks. I replaced the window well and sealed the flashing and it still leaks occasionally at one corner. What could be the problem?

If it were my house, I'd remove the skylight and replace it with a new one. Repeated leaks are a sign of faulty installation or damage.

A skylight can be installed in one of two ways: above the roof deck on a small curb or set into the deck. The former method is best used on shallow roofs or when the skylight is positioned near a wall that meets the roof. By elevating the skylight, the curb makes it less vulnerable to leakage caused by water that accumulates on the roof or that runs off a sidewall. Flush-mounted skylights are typically installed on steeper roofs.

Before purchasing a skylight, you might want to visit the manufacturer's website and make sure it offers detailed installation instructions.

KNOW YOUR STUFF

Fillers

	SPACKLING PASTE	COLORED WOOD PUTTY	EPOXY STICK	EPOXY-BASED WOOD FILLER
BEST FOR	Filling small cracks and minor dents in wood, masonry and metal.	Concealing nail holes and minor surface blemishes.	Odd jobs, repairing metal, or resetting hardware on knockdown furniture.	Rebuilding painted wood architectural elements, such as windowsills.
DETAILS	Formulated for specific jobs, such as interior or exterior work, or shallow dents, such as those in metal doors.	A soft putty that retains its flexibility. Buy several shades and blend to make a perfect color match.	Inner and outer portions of stick must be mixed thoroughly and used quickly before the mixed portion hardens.	Carve off excess before it hardens to reduce the need for excessive sanding or grinding.

STUDIO D; ILLUSTRATIONS BY GABRIEL SILVEIRA

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Foundation Gyration

We have clay soil where we live in Alabama, and when it dries out, big cracks form in the soil and sometimes foundations move. Severe cracks developed in our neighbor's foundation, and we want to be sure the same thing doesn't happen to us. What should we do?

It sounds like your house is located in a region with a high concentration of something known as expansive clay, a type of soil that can heave sidewalks and crack foundations. It causes millions of dollars in property damage every year, yet the phenomenon is little known to laymen outside the areas where it occurs (mostly in the southern and western U.S.).

The culprit is a clay with a molecular structure that attracts water molecules, causing the clay to expand dramatically—sometimes to two or three times its normal volume. Then, as the soil dries out, it contracts just as severely.

The best thing you can do is to keep the soil's moisture at an even, optimal level, and you'll need some expert advice to find out what that level is. It can vary depending on the site, soil conditions in the region and the amount of rainfall your area experiences. For example, a tree can shade a site and prevent rapid drying of the soil (a good thing) or its roots can be long enough to press against a foundation and pull moisture from the soil or clog a footing drain (a bad thing). Only someone who is an expert on local conditions will know whether you should keep the tree or fell it. They may advise digging a test pit to see if the tree's roots are encroaching on the foundation wall. Before you do anything, consult a civil engineer with soils-engineering experience. In some regions, foundation-repair companies handle this work.

Common sense can also go a long way in preventing problems. For example, if you notice the soil has dried out near the foundation and a gap has opened around it, don't hose down the area, flooding it in an attempt to moisten the soil and close the gap. This can cause water to run down the foundation wall and erode soil away from it, enlarging the gap in the process and perhaps even undermining the building's footings. Instead, if a long dry spell is forecast, run sprinklers on the lawn (about 4 feet from the foundation) to keep the soil moist. **PM**

PHOTOGRAPH BY ALAMY

IN THE NEWS

Are White Roofs Worth the Cost?

People don't usually turn to late-night comedy shows for home-improvement advice, but *The Daily Show with Jon Stewart* recently weighed in on roofing materials when U.S. Secretary of Energy Steven Chu extolled the virtues of reflective or "cool" roofs.

In ideal conditions, light-colored roof shingles can reflect summer heat to save up to 20 percent on air-conditioning costs.

"When you're thinking of putting on a new roof, make it white," Chu said. He cited research by Hashem Akbari at the Lawrence Berkeley National Laboratory, which found that white or light-colored rooftops reflected enough sunlight from a building to trim air-conditioning bills by as much as 20 percent. So should all Americans start planning to replace their roofs? Not necessarily.

The savings generated by a cool roof won't equal the costs of re-roofing, Akbari says, so the step should really only be considered for new roofs, or for aging roofs already due to be replaced. Flat-roofed commercial structures gain the greatest benefit from going white because they directly reflect sunlight, Akbari says—pitched house roofs don't reflect light as effectively, and buildings with vented, insulated attics already prevent rooftop heat from transferring to the conditioned spaces below.

But the science is sound, even in places with light a/c loads. Tim Leonard of ERSystems, a roofing manufacturer in Minnesota, compared summer savings for white roofs against the energy saved when a dark roof absorbs solar heat in winter. White roofs won, with four to five times as much money saved, even so far north. "It's not until you get up into Canada that the cost benefit starts to even out," Leonard says.

California has mandated cool roofs since 2005, and more recently, Chicago enacted new standards requiring reflective roofs. Those rules have helped create a list of compliant products, available at *cityofchicago.org*. Cutting one-fifth of a/c costs usually won't save a whole lot of money. But for homeowners ready to re-roof, the savings should cover the price to switch. On Chicago's list, light shingles cost little or no more than dark ones.

— ANDREW MOSEMAN

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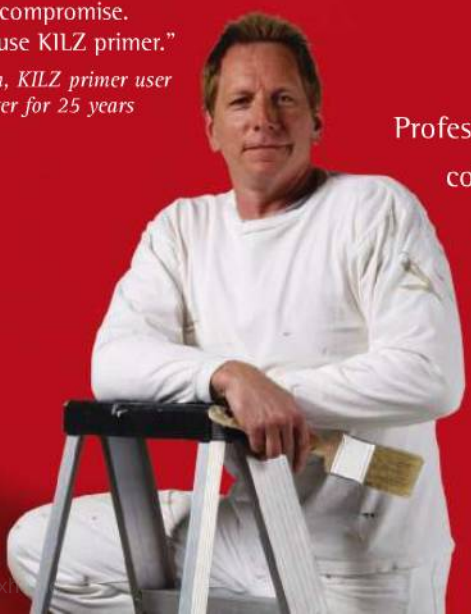

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